EDITORS' PICKS–14 FAVORITE CHARGERS

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MODEL Airplane NEWS

THE SECRET TO PERFECT AEROBATICS

page 116

Build an electric twin Me 262

Ryan STA
Giant-scale ARF

HOW TO'S
Easy fun-fly setups

Make a scale static prop

MOKI MUSCLE
2.10 2-STROKE

OCTOBER 2001

WE REVIEW
- **CAP 232**–60-size aerobat
- **Mirage**–park-flyer jet
- **Soarstar**–easy-flying trainer
- **Ford Flivver**–ARF classic

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MODEL Airplane NEWS

OCTOBER 2001 • VOLUME 129, NUMBER 10

ON THE COVER: *main image—the Great Planes Ryan STA, a giant-scale, almost-ready-to-fly model, receives high marks from senior editor Chris Chianelli; see his comments on page 38 (photo by Walter Sidas). "Real Performance Measurement" columnist Dave Gierke evaluates the new Moki 2.10 2-stroke powerhouse; see his article on page 92.*

Features

Construction

Field & Bench Reviews

Columns

Departments

EDITORIAL

BY DEBRA SHARP

Charging up

There's one field and shop tool that every modeler needs: a good battery charger. Whether you use batteries to drive your electric-powered airplane or simply to power your radio equipment, a reliable, easy-to-use charger is a must. Because there are dozens of good chargers on the market, selecting one that best suits your needs can be difficult. The best information comes from hands-on experience, so we polled our contributors and have come up with 14 favorite chargers. Whether you're looking for a simple, affordable field charger or a high-end, multifunction unit, you'll find the inside information here, along with tips on Ni-Cd and NiMH battery care and maintenance.

At the 2001 Soaring Festival, Tom Ramirez launches Max Parubrub's EPP-foam Lockheed T-33, an original design by Wade Kloos.

In this month's "Flight Techniques," "IMAC Aerobatics" columnist Dan Wolanski illustrates the most important building block of aerobatic sequences: straight-and-level flight. Although this seemingly simple part of your routine isn't given as much attention as more exotic maneuvers, for high flight scores, you need to master it. Read his illustrated explanation on page 116 to learn why straight-and-level flight looks different at various altitudes.

The newest breed of fun-fly airplanes can do incredible stunts, but you need to use your computer radio's mixing features to take full advantage of these designs' impressive maneuvering capabilities. In his "Effective Programming" column this month, Don Edberg explains basic fun-fly mixing: flaperons, elevator to flap, airbrakes and more, and he provides step-by-step procedures to properly set up your radio.

This month, prolific electric airplane designer Mark Rittinger offers one of his most exciting models yet: a twin Speed 400, prop-driven Messerschmitt 262. With great scale looks and jet-like flight performance, this balsa and lite-ply model is built using conventional construction techniques and is surprisingly easy to set up and fly. Judging from the reactions of all who have seen this airplane, Mark's Me 262 could be one of our most popular plans yet; if you'd like a unique twin to build this fall, this design may be just what you're looking for.

When the best scale slope soarers gathered at the 2001 Southern California Power Scale Slope Soaring Festival at Cajon Summit, photojournalist Dave Garwood was on hand to capture the action. His feature showcases some of the best streamlined models of powered aircraft flown today; see the excitement on the slopes on page 68. ✈

MODEL Airplane NEWS

FOUNDED 1929

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AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous number of letters we receive, we cannot respond to every one.

BITTEN BY THE BACKYARD BUG

I've got to tell you that your "Backyard Flyer" column in the August 2001 issue of *Model Airplane News* was the reason I picked up the magazine. My recent renewed interest in flying RC planes has been inspired by the smaller, simpler backyard flyers, mainly because their simplicity gave me hope that I, too, could fly an RC plane.

As a kid, I rode my bike miles to Victory Park in Pasadena, CA, every weekend just to watch the older guys fly free-flight gliders (this was back in the early '50s). It became my lifelong dream to do that, too, but I never had the opportunity until I recently spotted a Horizon Hobby Firebird XL in a hobby shop. This renewed my interest and gave me hope, for it was a reasonable investment with a super-easy radio-control system. Once I started working on and assembling it, my enthusiasm increased even more. That is when I discovered your article.

I'm extremely glad to have stumbled on this new adventure. The plane you wrote about—the Megatech Merlin—caught my eye, as well. After reading your article, I now

understand that there are many more planes out there to fulfill my childhood dreams. I am excited and look forward to more "Backyard Flyer" columns.

I'm looking forward to introducing my 13-year-old nephew to flying; he will get right into it, I'm sure. This new hobby will keep me smiling and having fun! You're never too old or too young for these new planes. Thanks for being there that day at the magazine stand.

LEE A. STARRETT
British Columbia, Canada

Congratulations on the new "Backyard Flyer" column. It was just what I needed, and I've ordered a Merlin of my own to fly. I had been undecided about which park flyer to buy, but you helped me make up my mind. I have a couple of questions, though: you modified the looks of your Merlin, and the decals are different from most. Where did you get the red ones that you used on your Kamikaze? Did you use a 6- or 7-cell battery pack, and do you think it makes much of a difference? And, I've noticed on some other park flyers that the folks added extra dihedral to the aircraft. Would this help the Merlin, or is it unnecessary?

Thanks for your help. I hope that the Merlin is as easy to fly as you said it would be; it seems as though I am going to use it as a learning vehicle. I think your first column turned out really well and that it will be a good addition to the magazine and a big help to us fliers.

DAVID VON STEIN
Middleburg, FL

Lee and David,
Thanks for your enthusiasm; I really appreciate it. The reasons you both gave for liking the column are exactly why we started it. Being on target with readers' needs is what we editors are here for. Hitting the bull's-eye, as it seems we've done with the "Backyard Flyer" column, makes it all worthwhile for me.

Regarding your questions, David:

- *The Japanese "meatballs" were cut from MonoKote trim sheet material.*
- *I used mostly 6-cell packs; these give good duration and the type of performance you'd expect from a park flyer. Of course, there was a noticeable difference in performance using 7 cells.*
- *The Merlin needs no extra dihedral; it's a great trainer just the way it is.*

Have fun with your Merlins, guys, and welcome to the new world of the backyard flyer; it's great stuff, for sure. CC

ENGINES DON'T LIE

Is there any information that comparatively evaluates glow plugs from various manufacturers? I have been unable to identify any objective information relative to glow plugs. The folks at the local hobby shops say there is no significant difference among brands, but my engines do not agree. There is a significant difference in performance when plugs are switched. However, are O.S. plugs really worth nearly double the cost of other brands? If so, why? It would be great if someone explained the science behind glow plugs and evaluated the available brands.

What are the primary causes of glow-plug failures? I recently flew an airplane every day for four days. It operated flawlessly. I put it away for two days, and when I tried to fly it on the third day, the engine was erratic and died twice in flight. A glow-plug change fixed the problem. I am relatively new to the hobby (1½ years) and have been unable to find any data on this subject with which to educate myself.

JOHN MECALO
Affton, MO

John,
Always trust what your engine—not a salesman—tells you. The most glaring example of the contention "The right plug can make the difference" is the 4-stroke glow engine. Although I am testing a few brand-new plugs designed for 4-strokes, as of this moment, the O.S. "F" plug is the only way to go in your 4-stroke engine—period! Everything else comes in a distant second. The "F" plug makes any 4-stroke more reliable and gives markedly improved idle and throttle response. This goes for every 4-stroke, regardless of brand or displacement, that I've ever tried—and I've tried them all, many times over. Think of it this way, John: you never know what's hiding out there in the high weeds a mere 500 feet from the runway. If your favorite model goes deadstick a little too far out and slams into something like a tree stump, an old washing machine, or a rusted-out '52 Packard, you're going to wish really hard that you had spent the extra 5 bucks for an O.S. plug; trust me on this one.

You know, we've never done an across-the-board glow-plug comparison. Hmm ... I believe that's something we need to think about. CC ✈

AIR SCOOP

BY CHRIS CHIANELLI

New products or people behind the scenes: my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

Hangar 9

Aresti 40 Sport Pattern Plane

If you've mastered the basics and want to explore the world of aerobatics, Hangar 9's new Aresti Sport 40 is the plane for you. Made of balsa and ply and covered with Ultracote, the Aresti comes 90 percent assembled and includes all of the necessary hardware and fiberglass wheel pants and cowl. With a 55-inch wingspan and a weight of 5 to 6 pounds, this quick-to-build sport pattern plane is perfect for new students and skilled aerobatic pilots.

Hangar 9; distributed by Horizon Hobby, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 352-1913; fax (217) 355-1552; www.horizon-hobby.com.

Kyosho

Super Quality P-40 Warhawk

If you're a fan of classic fighters, you'll love the newest addition to Kyosho's Super Quality Series of warbird ARFs. This .40 P-40 Warhawk can be ready for flight in just a few hours. The P-40 is constructed of strong, light balsa and covered in non-glossy camouflage film. The kit includes a fiberglass cowl, high-quality hardware and all the decals necessary to re-create the distinctive shark's-mouth nose. The Warhawk weighs 6 pounds; its wingspan is 56 inches and its wing area is 527 square inches. The Warhawk requires a .40 to.46 2-stroke or a .52 4-stroke engine and is priced at $279.99.

Kyosho; distributed by Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

MRC/Altech

Dago Red and Shuttle Sceadu

OK Models and MRC/Altech have teamed up again to release a new and better version of the ever popular EZ Dago Red .45. The newest Dago includes new molded components, an advanced airfoil design, lightweight construction, durable retracts and wheels and heavy-duty, fully repairable covering. A one-piece color-matched cowl, inverted engine design, detailed cockpit with pilot, and hidden elevator linkage complete its scale look and improve its overall performance and appearance.

MRC/Altech's line of high-quality helis continues to grow in both popularity and size with the addition of the Shuttle Sceadu. Available in .30 and .50 sizes, the Sceadu's new design features standard thrust bearings, adjustable Bell and Hiller ratios and an encapsulated, foam-lined battery box. Factory-assembled, 550mm wooden prop blades come as standard equipment in the .30 size, and 570mm fiberglass blades are included in the .50 size. The Sceadu has a tail-rotor diameter of 9.6 inches and a length of 46.85 inches. The .30 heli requires a .30 to .38 engine. The .50 Sceadu requires a .50 to .53 engine. Call for prices.

Model Rectifier Corp. (MRC), 80 Newfield Ave., P.O. Box 6312, Edison, NJ 08818; (732) 225-6360; www.modelrectifier.com.

Northeast Sailplane Products

Lil' Elipstick

You can now take the flying fun of the Elipstick indoors with the ARF Lil' Elipstik. Half the size of its predecessor, the Lil' Elipstick has a wingspan of 29 inches and a wing area of 240 square inches, and it weighs only 6 to 8 ounces. Powered by a direct-drive Speed 280 motor, the Lil' Elipstick flies smoothly and as fast or as slowly as you want. At $79.95, this pocket flying wing is a must-have for any indoor-flight enthusiast.

Northeast Sailplane Products, 948 Hercules Dr., Ste. 12, Colchester, VT 05446; (802) 655-7700; www.nesail.com.

Top Flite

Golden Edition Sea Fury

The Top Flite Golden Edition Sea Fury is easy to build and would be a great addition to any RC military enthusiast's hangar. It boasts plenty of scale touches, including ABS air scoops, landing-gear doors and wing blisters. Its fully interlocking, lock-and-tab, I-beam wing construction is simple and straightforward, and the kit includes a hand-laid, gelcoated fiberglass cowl that combines lightness with strength. The Sea Fury has a 64-inch wingspan and weighs 10 to 12 pounds, is 58 inches long and can be powered by a .91 to 1.20 4-stroke powerplant. It is priced at $269.99; a cockpit kit is available for $21.99.

Top Flite; distributed by Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

Hobby Lobby International

Star Jet and Cosmic Wind

The folks at Hobby Lobby and Graupner have joined forces again to bring you two great new products. The ready-to-fly Graupner Star Jet RTF Electric Flying Wing is an all-foam aerobat that can fly for more than 10 minutes while running on twin Speed 400 motors and a 7-cell Ni-Cd battery. The Star Jet has a 47-inch wingspan and weighs 53 ounces, is 31 inches long and has a 630-square-inch wing area. Priced at $99, the Star Jet comes with a ready-made ABS fuselage bottom reinforcement and all the necessary hardware and decals.

You'll be amazed by the flying capabilities of the ready-to-cover Graupner Cosmic Wind Formula 1 RTC. It comes with a fiberglass fuselage, a ready-made and sanded one-piece wing with slotted aileron and servo wells, solid balsa tail feathers, formed landing gear, a clear plastic canopy and all the necessary hardware. The Cosmic Wind has a 47-inch wingspan, is 38 inches long and weighs 5.1 pounds; it sells for $189. Graupner recommends that it be run on a Jet Phaser brushless motor with a 7-cell Ni-Cd and a 4-channel Hitec Focus radio.

Hobby Lobby Intl., 5614 Franklin Pike Cir. Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948; www.hobby-lobby.com.

Global Hobby Distributors

Cirrus 2M ARF Glider

The affordable, 3-channel Cirrus 2M represents the next generation of ARF gliders. It handles smoothly enough for a beginner but offers all the performance capabilities of a competition sailplane. The Cirrus 2M features a highly efficient airfoil that will both penetrate and float and also has built-in spoilers that will ease landings. It's made entirely of built-up wood using a double shear web and a double spar with D-tube sheeting—a reliable, strong construction. The Cirrus 2M ARF has a 78.25-inch wingspan and sells for $99.99.

Cirrus; distributed by Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728; (714) 962-0827; fax (714) 962-6452; www.globalhobby.com.

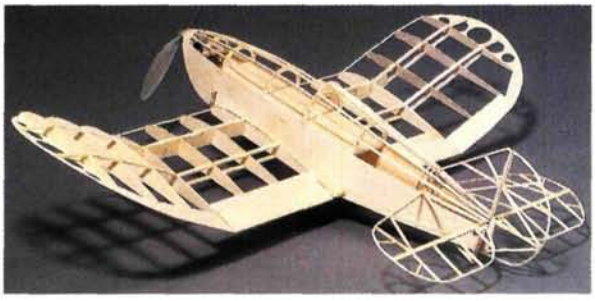
Thunder Tiger

G-202 140 ARF and Tiger Bipe 40 ARF

The folks at Thunder Tiger have certainly been busy. The G-202 140 ARF represents that company's first entry into the world of giant-scale aerobatics, and it's perfect for modelers who want an affordable plane with TOC performance in short order. The G-202 is constructed of balsa and ply and covered with Ultracote. It features a painted fiberglass cowl, wheel pants and bottom wing cover and comes with many scale accessories. The G-202 has a 70-inch wingspan, can be powered by a 1.08 to 1.6 2-stroke or a 1.2 to 1.8 4-stroke engine and sells for $324.99.

Take a trip back in time with the Tiger Bipe 40 ARF. This handsome sport balsa-and-ply biplane is covered with Ultracote and is perfect for any .35 to .54 4-stroke engine. With a 49-inch wingspan and a weight of 4.5 pounds, you can expect only sprightly and predictable flight from the Tiger Bipe. Its compact airframe will fit in almost any vehicle, and it can be in yours for only $169.99.

Thunder Tiger; distributed by Ace Hobby Distributors, Inc. 116 W. 19th St. Higginsville, MO 64037; (660) 584-7121; www.acehobby.com.



Great Planes

Li'l Poke Park Flyer

With Li'l Poke, now you can enjoy the sleek design of the SlowPoke .10 to .25 and Sport 40 models but in a smaller and lighter package. At just 27 inches long with a 36-inch wingspan, the Li'l Poke can be flown just about anywhere. It may be small, but it's just as sturdy and maneuverable as its predecessors, and its simple, straightforward design means it can be assembled in a weekend. Unlike many park flyers, Li'l Poke's wings feature two spars that contribute to the strength of its all-wood frame; yet it maintains a flying weight of less than 16 ounces! Li'l Poke comes as a kit and runs on a 280-size motor. It sells for $64.99.

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

SpecCast

Three New Quality Die-Cast Collectibles

We just couldn't resist including these new static treasures in this month's "Scoop." From SpecCast Quality Die-Cast Collectibles come three models you can really sink your money into. Sure, there's nothing like watching your model soar through the sky, but it sure would be nice to own one that actually saves you money! The U.S. Mail Ford Trimotor, the Farm Safety 4 Just Kids "Miss America" P-51 Mustang and the John Deere JD01 Corsair serve a unique function: they're die-cast banks. Simply open the hatch, remove the canopy or detach the drop tank to reveal the hidden coin slot and make your deposit.

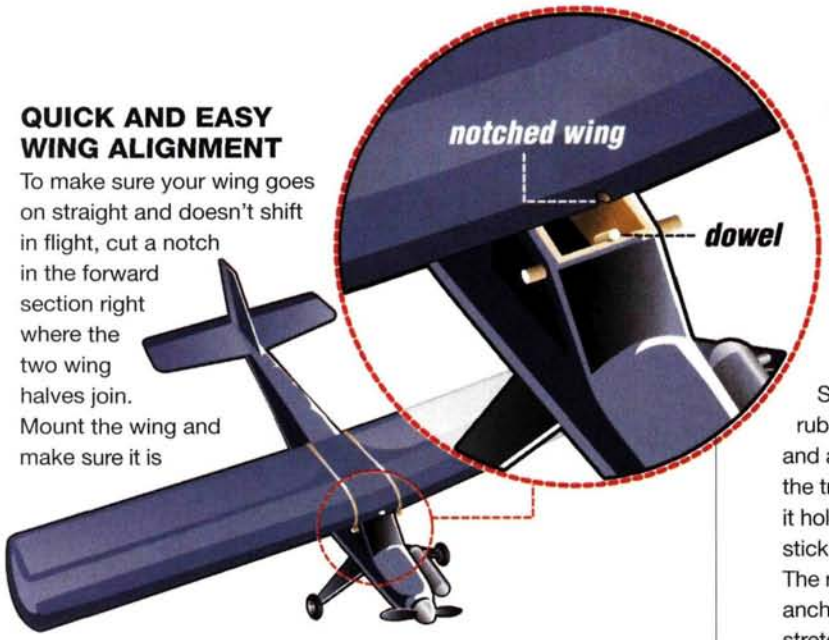
SpecCast, 428 Sixth Ave. NW, P.O. Box 368, Dyersville, IA 52040; (319) 875-8706; fax (319) 875-8056; www.speccast.com.

READERS' TIPS & TRICKS

WITH ILLUSTRATIONS BY DAVID BAKER

SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Readers' Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.

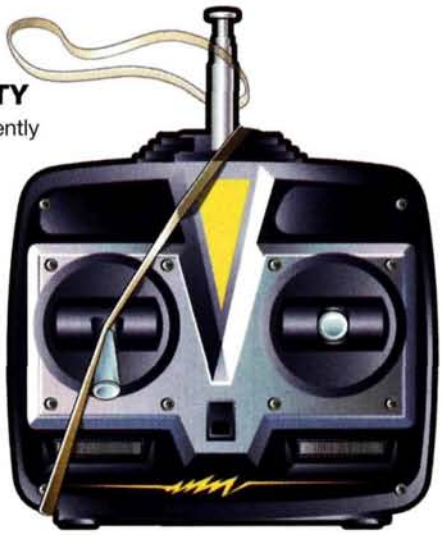
QUICK AND EASY WING ALIGNMENT



To make sure your wing goes on straight and doesn't shift in flight, cut a notch in the forward section right where the two wing halves join. Mount the wing and make sure it is perfectly aligned with the fuselage, then mark the top of the fuselage that is visible in the notch. Take the wing off, and drill a hole at the marked location. Put a dowel of a diameter that matches the notch in your wing into the hole drilled in the fuse, and CA the dowel into place. Now, when you mount your wing, simply drop the slot in over the dowel to ensure perfect alignment; this saves time at the field, and helps to ensure more consistent handling whenever you fly your model.

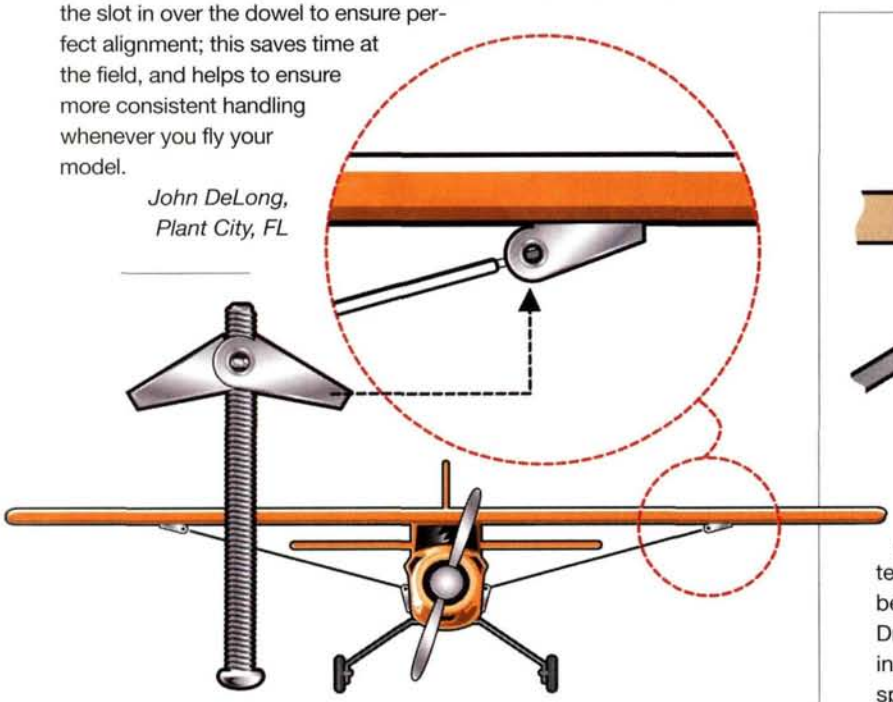
John DeLong, Plant City, FL

THROTTLE-STICK SAFETY



To avoid inadvertently starting your electric model's motor at full throttle when you switch it on, try this. Stretch a no. 64 rubber band down and across the front of the transmitter so that it holds the throttle stick in the off position. The rubber band can be anchored on the antenna, stretched down the front of the transmitter case, around the bottom, over the back of the case and back to the antenna. When you're ready for takeoff, push the rubber band aside, and off you go.

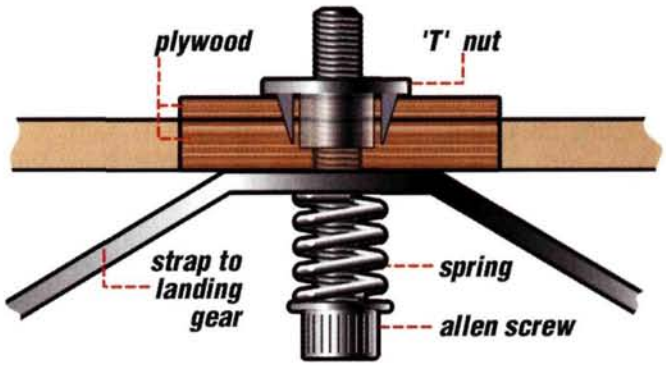
Roy McGuckin, San Diego, CA



TOGGLE-BOLT STRUT ATTACHMENTS

Toggle bolts used to secure screws to sheetrock walls (available at hardware stores) make excellent scale attachments for wing struts. The bolts come in various sizes and can easily be disassembled to produce two perfectly matched strut mounts.

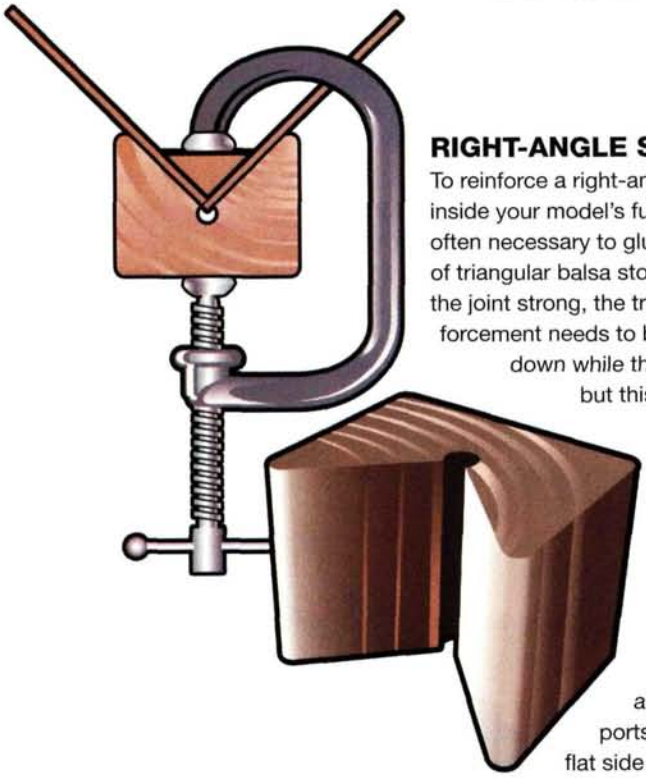
Don Orndorf, Millersburg, PA



LANDING-GEAR SUPPORT

If you need to add support or increase the shock-absorbing capability to your landing gear, try this simple technique: reinforce the spot in the center of your fuselage between the gear struts with a couple of layers of plywood. Drill a hole in the plywood from inside the fuselage, and insert a 'T' nut into this hole. Slip a washer and then a spring over a bolt or an Allen screw of the appropriate size, and thread the bolt through the landing-gear strap and into the 'T' nut. Tighten the bolt until the spring starts to be compressed. This makes an adjustable shock-absorbing landing gear that can easily be retrofit to an existing model.

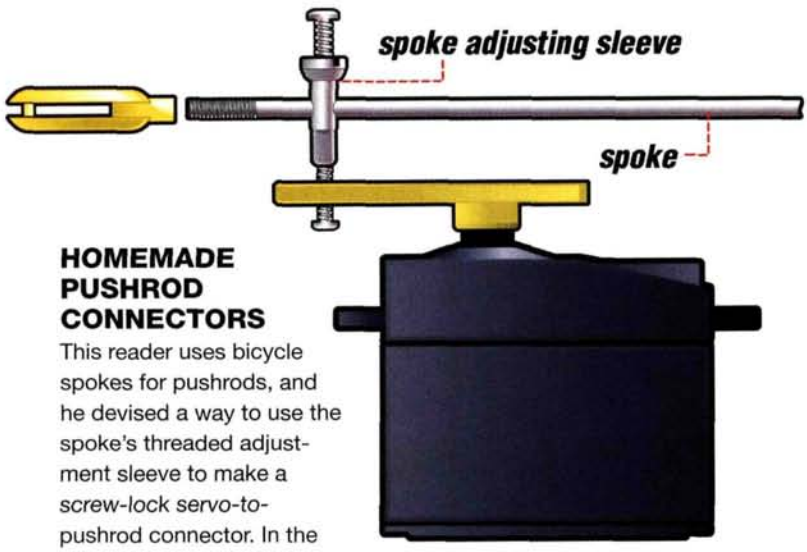
Avey Shaw, Huntington Station, NY



RIGHT-ANGLE SUPPORT

To reinforce a right-angle joint inside your model's fuselage, it is often necessary to glue in a piece of triangular balsa stock. To make the joint strong, the triangle reinforcement needs to be clamped down while the glue dries, but this can be difficult to do using a standard C-clamp. It will be easier if you make a V-shaped block that aligns and supports the joint. The flat side will sit firmly against the clamp while the "V" maintains the right angle and applies the pressure needed to make the glue adhere properly. Use a hardwood such as maple so the block can be used repeatedly. I like to drill a 3/16-inch-diameter hole at the bottom of the "V" to relieve corner stress.

Conrad Ricker, Orland Park, IL



HOMEMADE PUSHROD CONNECTORS

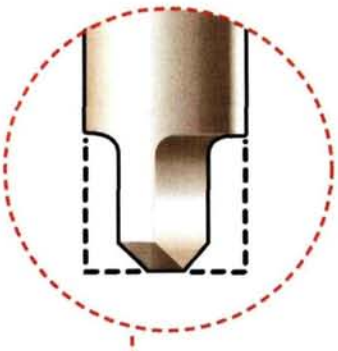
This reader uses bicycle spokes for pushrods, and he devised a way to use the spoke's threaded adjustment sleeve to make a screw-lock servo-to-pushrod connector. In the side of the sleeve, drill a hole that's the diameter of the pushrod. Thread a 2-56 machine screw into each end of the sleeve—one to attach the sleeve to the servo arm and one to lock the pushrod in place. For tight installations, you can file up to 1/8 inch off one end of the sleeve without affecting the locking screw.

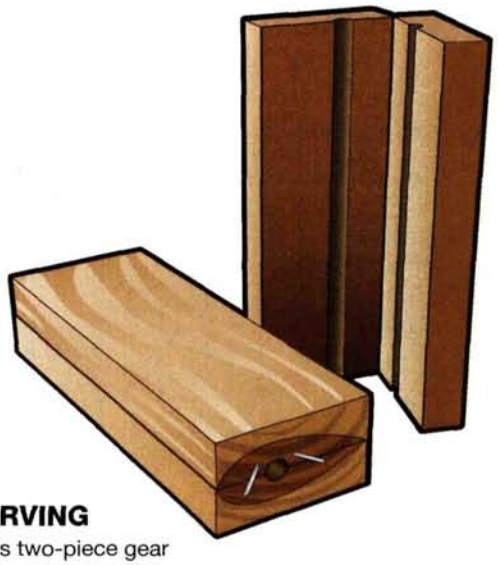
Bill Nairn, Ft. Lauderdale, FL

EXTENDED DRILL BITS

If you have to drill a particularly deep hole, you may find that your standard bit set can't handle the task. There is an easy solution: make your own bit out of music wire! On a bench grinder, disc or belt sander, take wire of the length and diameter required for your application, and grind the end to a blunt 30-degree angle. Then grind a flat on each side and bevel the edges. Presto!—extra-long bits of any diameter and length.

Doc Morrison, Houston, TX





CLAMPLESS CARVING

Scale parts such as this two-piece gear strut cover sometimes have to be carved out of separate pieces of wood that must fit together precisely. Carve the slot for the landing-gear wire, then using thin wire staples, staple the two pieces together in a triangular formation. Carve the halves as if they were a single piece. When the shape is to your liking, pull out the staples, and you have perfectly matched halves.

Charles Angevine, Lake City, FL

PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable but please do not send digital printouts. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

ELEGANT "E"

Following *Model Airplane News* plans, Henry Simon of Bobcaygeon, Ontario, Canada, scratch-built this 6-foot-span WACO Model E, but made a few slight modifications. Henry included aluminum wing struts, removable landing gear, a tapered fuselage, operational landing and navigation lights, hinged cabin and baggage doors, a replaceable front windshield, removable front and rear seats and a Fiberglass Specialties 8½-inch-diameter cowl. He powers his model with an O.S. FS-91 Surpass II turning a 15x6 prop; it is controlled by a Futaba Skyport GYG radio with six servos. Henry's WACO weighs in at 11 pounds, 5 ounces and is finished with Coverite's 21st Century fabric.

FLYIN' DRAGON LADY

This photo of a Model Tech Dragon Lady comes to us from Jeff Pogar of East Patchogue, NY. "Jeff's Toy" has a 66-inch wingspan and is powered by a SuperTigre GS 40 with a Slimline muffler that features a smoke preheater and a TME smoke pump. It's guided by a Futaba 8UAPS computer radio with four servos and is finished with sapphire-blue and white MonoKote. The model also includes two battery packs and two fuel tanks, and according to Jeff, it flies like a true sport plane.

DESIGNER ELECTRIC

Dale Martell of Weaverville, NC, designed and built this twin-motor electric with the help of his ModelCAD program. "Electwin" has 650 square inches of wing area, weighs 5½ pounds and has a wingspan of 68 inches. Dale installed AstroFlight Cobalt geared .05 motors turning Master Airscrew 12x8 nylon props. With 14 cells powering the motors, Dale says his original design not only flies easily off grass fields, but it also does great aerobatics.

SCRATCH-BUILT SKYROCKET

John Giles of Oklahoma City, OK, scratch-built this German Skyrocket, which is powered by two Saito .56 engines turning APC 12x6 props. John included a reinforced and fixed gear so that he'd be able to fly from grass fields, and he broadened the wing to ease take-offs and landings. This is John's second Skyrocket and fifth twin, and he assures us that it's not only fun to fly but also a real crowd-pleaser.

FLYIN' MISS DAISY

This photo of a P-51D Mustang was sent to us by Tony Kameen of Moreno Valley, CA, who built the 9-pound, 60-inch-wingspan warbird from a set of modified Bryan Taylor plans. Powered by an O.S. .61FX 2-stroke, the model features cycling gear doors and drop tanks. Modeled after Lt. Tom Leaver's plane from the 47th Fighter Squadron, 15th Air Force in late 1945, Tony's plane is covered with Goldberg Ultracote and MonoKote, paint, Mylar insignias and Testor's Modelmaster and Perfect Paint sealer stripes. Tony scratch-built the struts and drop tank and tailwheel mechanisms, and the Daisy Mae logo is his own artwork.

DER FIRST-PLACE FINISH

Wayne Jaax of Brooklyn Center, MN, sent us this photo of his ¼-scale Der Jäger, which he built from a Balsa USA kit. Wayne's model has a top wingspan of 60 inches, weighs 24 pounds and is powered by a Zenoah G-62 gas engine. It's covered with Sig Koverall and finished with Benjamin Moore semi-gloss latex house paint. Wayne's local paint store matched the yellow from a metal chip taken from a school bus. Pictured with the plane is the trophy Wayne earned for taking first place in a local contest.

SEATTLE YAK

Rick Glatthaar of Seattle, WA, sent us this photo of his Yak 55M that was built from a Flair kit. Rick's plane has an all-built-up construction with a 79-inch wingspan and a flying weight of 13 pounds. Modeled after a full-size plane, this Yak is covered with Goldberg Ultracote and powered by a Brison 2.4 engine turning a Mejzlik 19x8 prop. Rick installed a fiberglass cowl with functional louvers to aid in engine cooling, and he controls his plane with a Futaba radio and Hitec high-torque servos. This is the largest model that Rick has ever built, and he's proud to say that it looks extremely scale in the air and has great aerobatic capabilities.

HAPPY PUP

Carl Schurenberg of West Chester, OH, built this Sopwith Pup from a Balsa USA kit and modeled it after the plane flown by Flight Sub Lt. Breadner of the RFC No. 3 Naval Squadron in WW I. "Happy" is a ¼-scale model with a 77-inch wingspan. It weighs 15 pounds and is powered by a Zenoah G-23 gas engine. Carl's model features a steerable tailwheel, a mounting step, wing rigging, inspection panels and machine-gun feed and collector chutes. Carl notes that according to the history books, the Sopwith Pup was the most pleasant of all the WW I planes to fly, and he sure hopes his model flies like the original.

BIG BIPE

Harold Mahoney of Albany, GA, enlarged a set of *Model Airplane News* plans to create this beautiful bipe. Harold increased the wingspan from 54 to 60.5 inches and installed a powerful US .41 engine. A Fiberglass Specialties Bücker Jungmann cowl, contributes to the model's sleek appearance. Harold controls his plane with a JR radio and says it flies just great!

◂ CHILD'S PLAY

When asked by his 6-year-old son to build a plane that looked like Thomas the Tank Engine, Tim Carpenter of Wadesboro, NC, employed a little innovation and created the model shown here. Tim modified the fuselage of a Great Planes Gee Bee to produce "Matt's Thomas," which, according to Tim, "flies as if it's on rails." ✈

BATTERY CHARGERS

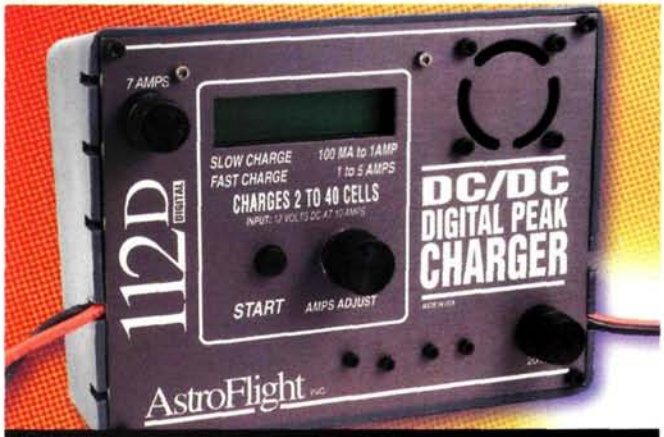
14 of our favorites and why we like them

by the staff of *Model Airplane News*

A good battery charger is one of the most valuable pieces of equipment you can purchase for your RC hobby. For the batteries that power our radios and drive our electric models to operate reliably and predictably, we need to take care of them properly.

We asked *Model Airplane News* contributors and editors which are their favorite chargers and why. This article highlights some of these chargers and offers advice on purchasing your next battery charger.

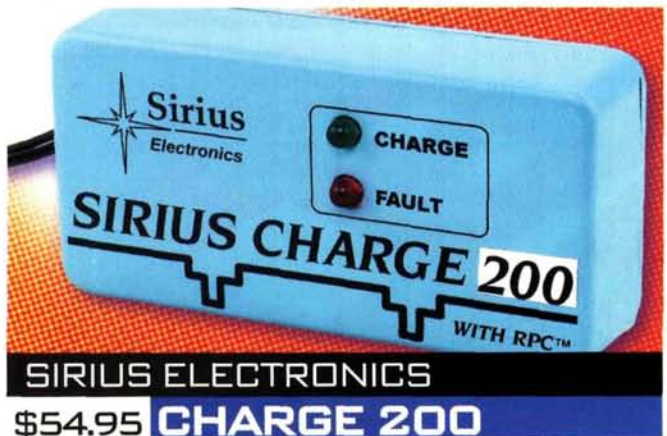
Several types of chargers are available, ranging from the very simple and inexpensive to the high-tech, multi-function type. First, you have to decide which type of battery packs you need to charge. Will you



ASTROFLIGHT
$150 112D

Input: 12V DC
Output: 100mA to 5A adjustable
No. of cells: 2 to 40; 50 to 5000mAh packs
Features: selectable fast- or slow-charge model; peak-charging; digital display of charging amps, battery voltage, charge time, total amp hours and maximum Ni-Cd voltage; built-in cooling fan; charges Ni-Cd and NiMH batteries.

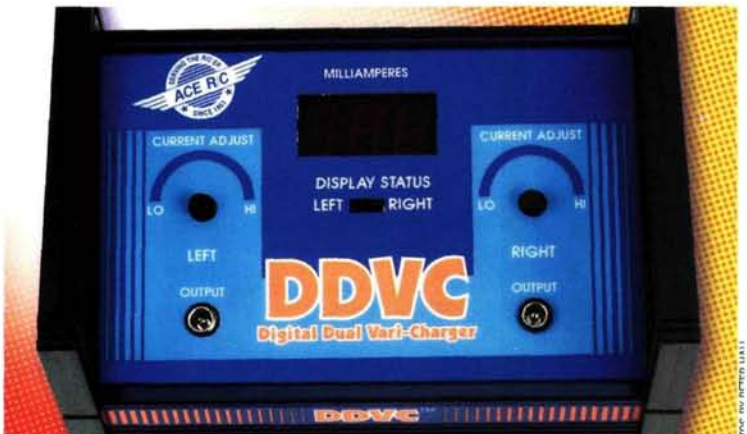
WHY WE LIKE IT
Rugged and reliable unit has easy-to-read LCD display. Auto-shutoff at 10 hours. Simple push-button operation with fast-charge one-hour time limit.



SIRIUS ELECTRONICS
$54.95 CHARGE 200

Input: 12V DC
Output: 200mA fixed
No. of cells: 4 to 8; 100 to 400mAh
Features: fully automatic operation for fast field-charging; charge and fault LED indicator; unit comes with universal RC connector for JR, Airtronics, Futaba and Hitec radios.

WHY WE LIKE IT
No adjustments required; just plug in pack and forget it. Good for small, 4- to 8-drive batteries for indoor RC flyers.



ACE HOBBY
$79.99 SUPER DDVC

Input: 120V AC or 12V DC
Output: 5 to 500mA adjustable
No. of cells: 1- to 10-cell packs; up to 5000mAh capacity
Features: dual-output circuits; current monitored by a 3-digit LED display and is accurate to 5mA; charges Ni-Cd and NiMH batteries.

WHY WE LIKE IT
Good for overnight peak-charging for TX and RX packs. Easy-to-read LED screen. Can be used to charge 12V lead-acid batteries.

charge only your radio's battery packs, or will you charge high-capacity drive battery packs? Perhaps you want a charger capable of doing both. Do you want a field charger, or one you can use in the workshop? Some can be used both indoors and out.

The simplest and least expensive charger is the fixed-rate timer-type. Though economical, it has limited use, and you risk overcharging and damaging your batteries if you charge them too long. You must constantly check your pack to be sure it doesn't overheat.

The most popular charger is the "peak detection" type that can determine when the battery pack has reached full capacity; it then automatically shuts off the fast-charge rate.

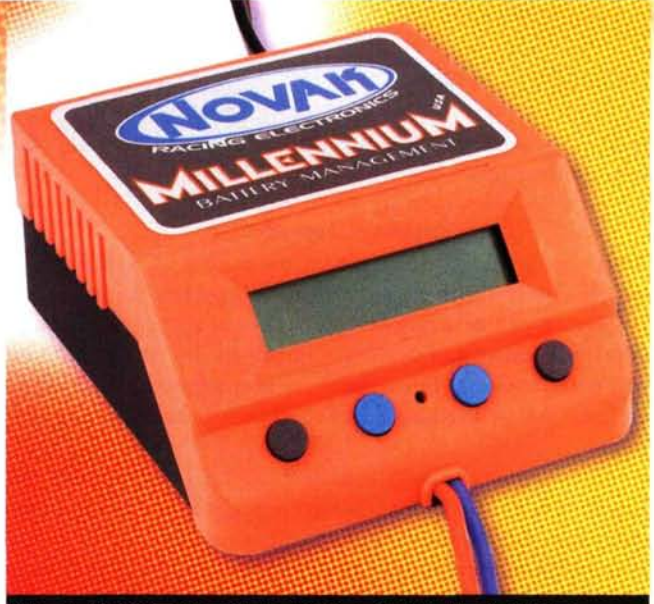
AC OR DC?

Basically, chargers are available with two input-voltage requirements: AC (alternating current; normal household 110 voltage) and DC (direct current; 12 volts supplied by a high-capacity automotive battery). AC chargers simply plug into a wall socket, and they contain a rectifier that converts the AC input current into DC output current. DC chargers have two alligator clips that you attach to the automotive battery's terminals to power the charger. Some chargers also come

GREAT PLANES $49.99
ELECTRIFLY PEAK CHARGER

Input: 11 to 14V DC
Output: 200 and 600mA selectable
No. of cells: 6 to 8
Features: peak-detector circuitry; 15mA trickle charge; fused-overload and reverse-polarity protection; charges Ni-Cd and NiMH batteries.

WHY WE LIKE IT
Compact and convenient to use, ideal for small electric-powered park flyers. Unit plugs directly into a car's cigarette lighter.



NOVAK RACING ELECTRONICS
$249 MILLENNIUM

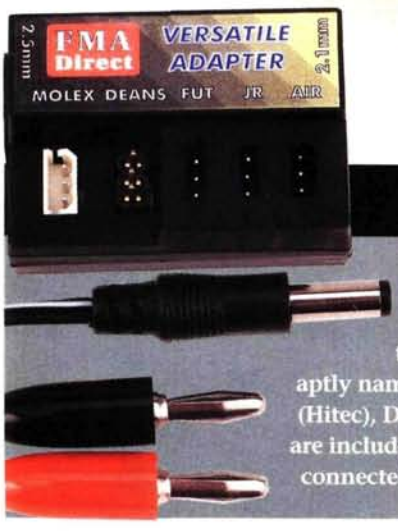
Input: 12 to 15V DC
Outputs: variable; trickle—100 to 400mA; linear and reverse pulse charge for Ni-Cds—500mA to 7A; NiMH charge rate—500mA to 1.5A
No. of cells: 4 to 8
Features: easy-to-read full-function digital display; Tri-Mode charging (linear, reverse pulse and NiMH); adjustable trickle-charge rate; automated battery analysis and conditioning; adjustable delta-peak; detailed charge history displays total charge time, peak voltage, capacity (mAh) and energy (joules); reverse polarity, short-circuit, short-battery and thermal-overload protection.

WHY WE LIKE IT
Flexible charging parameters. Easy-to-adjust push-button operation. Excellent for proper charging of NiMH packs.

BOB SELMAN DESIGNS
$30 BSPC3/CMW 1

Input: 12V DC
Output: 400mA, fixed (110 to 180mAh Ni-Cds)
No. of cells: 2 to 7
Features: LED status indicator.

WHY WE LIKE IT
Compact, light and simple to use—no buttons or adjustments.



GET CONNECTED

Unless you're just one of those people who gets their jollies from endless soldering, it can be a big pain in the tail feathers to put together patch chords and adapters for the myriad of connector types on your model equipment. The folks at FMA Direct understand this, and to spare you that aggravation and expense, they've come up with a simple yet amazingly useful solution. The aptly named Versatile Adapter incorporates seven connector types into a single compact unit. Molex (Hitec), Deans 3-pin male, Futaba J Type, JR, Airtronics as well as 2.1 and 2.5mm barrel-plug connections are included. The Versatile Adapter is designed for a DC power source, and positive terminals are all interconnected. More than 80 combinations of connections are possible! At just $9.95, this thing is a steal.

with a power-adapter plug that can be inserted into a car's cigarette lighter socket.

CHARGE AMPERAGE

Amperage is the measurement of the output current supplied by the charger. The greater the amperage, the more quickly your pack will be charged. The type and size of the cells in your pack determine what the amperage should be, and you will have to adjust your charger's output accordingly. Chargers are available in fixed, selectable and adjustable amperage output.

- Fixed output chargers usually have a timer that sets the length of time you charge your battery pack. The timer counts down and then turns off the output current.
- Selectable output chargers have two, three, or more amperage settings that you select before you attach your batteries; the charger quick-charges the pack, and when the battery is fully charged, it switches to a trickle-charge rate.
- Adjustable output chargers work like selectable chargers but allow you to precisely adjust the output current with a dial, knob, or button. Typically, the output range is from 0.5 to 5 amps. Again, after the fast charge is complete, the charger switches to a trickle rate.

CHARGE RATES

The three basic rates for charging battery packs are: "fast (or quick)," "overnight" and "trickle." The fast/quick rate is typically used at the flying field and will usually recharge your battery pack to full capacity in about half an hour. Depending on the type of battery you charge, the fast rate is about two times (2C) or three times (3C) the battery's capacity in milliamp hours (mAh). For example: for a 1000mAh (one amp hour) pack, the charge rate would be 2 or 3 amps.

The overnight charge (or "slow" rate) takes about 10 to 24 hours to fully charge a battery pack using roughly 1/10 (C/10) of the battery's capacity as the charge rate, e.g., 50mA for a 500mAh pack.

The trickle rate is a low-level charge that should be about 1/50 (C/50) of the battery capacity (20mA for a 1000mAh pack.) Your battery pack can be left on trickle charge indefinitely without harming the cells.

For the health and well-being of your battery packs, it is very important to properly match the charge rate/duration to the size and type of cell you charge.

DYMOND
$25.95 XING MINI

Input: 12V DC
Output: 1, 2, or 4 amps selectable
No. of cells: 4 to 7
Features: charges Ni-Cd batteries; pulsed trickle and quick charge; delta-peak auto-cutoff; reverse-polarity protected; LED-charge model indicator.

WHY WE LIKE IT
Inexpensive and easy-to-use unit ideal for small-drive battery packs. Simple to adjust.

HANGAR 9
$56.95 DOUBLE VISION

Input: 12V DC
Output: 800mAh fixed
No. of cells: 4- to 8-cell packs
Features: fast field-charger; peak-detection; provision for charging a single-cell glow-plug igniter battery at roughly 500mA current; reverse-polarity protected; RX and TX packs can be charged simultaneously; charge automatically switches to a trickle; charges Ni-Cd and NiMH batteries.

WHY WE LIKE IT
TX polarity selectable for Futaba/Hitec or JR radios. Easy-to-see LED display. Unit has jacks to attach a voltmeter.

FMA DIRECT
$140 SUPERNOVA 250S

Input: 12V DC
Output: variable charge current—100mA to 5A; variable discharge current—500mA to 3A
No. of cells: 1 to 25; 50 to 3000mAh capacity; Ni-Cd or NiMH
Features: 10-battery parameter memory with presets; internal cooling fan; EZ auto-check battery state for charge/discharge; zero-voltage measurement for delta-peak auto-cutoff; output short-circuit and reverse-polarity protection; functions for charging/discharging lead-acid batteries.

WHY WE LIKE IT
Excellent value. Fully automatic mode for one-touch charging. Good for use with small 50mAh packs. Auto-shutdown, if something goes wrong.

SIRIUS ELECTRONICS

$129.95 PRO SERIES

Input: 12V DC
Output: 250mA to 1A selectable
No. of cells: 4 to 8 (transmitter); 3 to 6 (receiver)
Features: 3 charge ranges (250, 500 and 1000mAh); simultaneous TX and RX charging; fully automatic with battery detection; can only be used only with TXs that do not have diode battery protection.

WHY WE LIKE IT

Simple operation; just select output range and attach the battery pack.

GLOSSARY OF TERMS

AC	Alternating current (typical household current).
Adjustable rate	Refers to a type of charger that has a range of variable output current that you can precisely adjust with a dial, knob, or button.
Amp	Ampere (a unit of electrical current).
Amperage	Strength of an electric current expressed in amps.
Charge amperage	Measurement of the output current used to charge the battery.
Capacity	Amount of electrical energy in mAh (milliampere hours) a battery can store.
Cycle	Refers to multiple charging and discharging cycles to determine the actual capacity and condition of a battery pack.
DC	Direct current (current supplied by a battery).
Fast charge	Also referred to as a "quick" charge; a charge rate (in mA) of between two and three times the battery capacity (2C or 3C).
Fixed rate	Refers to a type of charger that has only one fixed rate of charge current, and the length of time the battery charge is adjustable.
Input power	The electrical current that powers the charger unit. Input power is either AC or DC current.
mA	Milliamp; 1/1000 amp.
Ni-Cd	Nickel cadmium. Common type of battery chemistry. Can be fast-charged.
NiMH	Nickel-metal-hydride. Newer type of battery chemistry. Has more capacity than a Ni-Cd pack of similar size but should not be fast-charged.
Output power	The electrical current (measured in amps) supplied by the charger that charges the battery pack.
Overnight charge	Also referred to as a "slow" charge. A charge rate that is 1/10 the battery pack's capacity (C/10).
Peak detection	Charger circuitry that senses when the battery voltage begins to decrease, signifying that the battery cells are at full capacity.
Rate	Amount of electrical current (amps) supplied to the battery pack while charging.
Selectable rate	Refers to a type of charger that has two, three, or more charge rates that you select before charging the battery pack.
Trickle charge	A safe maintenance charge rate that is 1/50 the battery pack's capacity (C/50).

ACE HOBBY

$94.95 SUPER DIGIPULSE

Input: 120V AC
Output: 100 to 2000mAh adjustable
No. of cells: 1- to 10-cell packs
Features: six completely independent outputs; 1/5 overnight trickle rate; for Ni-Cd and NiMH batteries.

WHY WE LIKE IT

Easy to use and adjust. Excellent workshop radio-system maintenance charger. Auto-switch to trickle charge.

GLOBAL HOBBY

$139.99 CIRRUS CYCLE PRO

Input: 12V DC
Output: 500 to 1000mA selectable
No. of cells: selectable 1, 4, 5, 6, 7, or 8
Features: 250mA and 750mA selectable discharge; two output circuits; includes AC or DC operation with its own 3A DC power supply; cycles batteries from one to five times; charges Ni-Cd batteries; LEDs indicate charge or discharge operation.

WHY WE LIKE IT

Multifunction LCD screen. Easy to adjust and use. Offers basic cycling capacity for medium and large TX and RX packs at a reasonable price.

HITEC

$159.95 CG-335

Input: 9 to 15V DC
Output: 0.5 to 5.5 amps adjustable
No. of cells: 4- to 24-cell packs; 270 to 3000mAh packs
Features: DC-to-DC charging with booster circuit; glow-igniter battery-charging feature; delta-peak cutoff with automatic trickle; MOSFET drive control with pulse charging; input/output battery polarity protection.

WHY WE LIKE IT

Reliable performance. Charges more than one pack at a time. Use with small- and large-drive battery packs; also charges radio packs. Automatic 65-minute charge cutoff.

SKY HOOKS & RIGGING

$220 ORBIT SUPER

Input: 11 to 14V DC
Output: 50mA to 6A adjustable
No. of cells: 1 to 30
Features: fast or slow charging; charges or cycles Ni-Cd, NiMH, lithium-metal Tadirans, lithium-ion and lithium-polymer packs. Battery information is retained in memory; indicates if supply voltage is too high or too low and switches off after a few seconds if something is wrong; produces charts and data to record and analyze packs (computer program and PC cable kit available separately for $30).

WHY WE LIKE IT

Easy-to-read LCD screen. Good value for modeler interested in detailed analyses of battery packs. Informative, easy-to-understand instruction booklet. Soft-start charging gradually increases charge pulses for 2 minutes to protect weak cells.

CARING FOR NIMH CELLS

Two of my favorite cells for micro RC flying at currents of less than 4 amps (typical Speed 280 models) are the NiMH AP-600AAH and AP-270AAH, available though Batteries America.

- **AP-600AAH.** These are half the size of an AA cell and have the same physical properties as the 270AA and 350AAC Ni-Cd cells. At 4 amps, the 600AAH cells deliver nearly the same voltage as and nearly twice the capacity of the 270/350 Ni-Cds.
- **AP-270AAH.** These smaller cells are physically a third the size of an AA cell and the same size and weight as a 110AA Ni-Cd. They also deliver twice the capacity at the same voltage as Ni-Cds of the same weight and size.

If you treat these cells as you would high-capacity, slow-charge Ni-Cds, they will deliver just as many cycles. Treat them poorly, e.g., fast-charge them, and they will self-destruct in short order. Just like small Ni-Cds, charge them at the overnight rate of C/10; in other words, 10 to 12 hours at 27 to 30mA (for the AP-270AAH) and 60mA (for the AP-600AAH). In some models and applications, using the 600mAh cells, I can fly for more than 20 minutes on a single charge. Buy two packs, and that's well over 40 minutes of flying time! Why would you need to fast-charge them at the field?!

Another little tip: if you don't have a charger that will charge your 7- or 8-cell, 600mAh NiMH at 60mA, use the charger that came with your radio! Such chargers typically have a 60mA output (the wall charger's faceplate will generally tell you at what voltage and amperage it feeds the pack). Make an adapter to plug into the transmitter jack on the charger and then into the motor flight pack. Even though the transmitter side of the charger was intended for 8-cell packs, it is safe for 7- or even 9-cell packs. You could charge 270mAh NiMH packs on this, too, but you would have to pull them off in 5 to 6 hours instead of the usual 10 to 12 hours overnight. —*Tom Hunt*

Although this Ni-Cd cell (left) and NiMH cell are the same size and weight, the NiMH has nearly twice the capacity.

Ace Hobby Distributors, 116 W. 19th St., Higginsville, MO 64037-0472; (800) 322-7121; (660) 584-7121; fax (660) 584-7766; acehobby@ctcis.net; www.acehobby.com
AstroFlight Inc., 13311 Beach Ave., Marina del Rey, CA 90292; (310) 821-6242; fax (310) 822-6637; www.astroflight.com.
Batteries America, aka E. H. Yost & Co., 2211 D Parview Rd., Middleton, WI 53562; (608) 831-3443; ehyost@midplains.net; www.batteriesamerica.com.
Bob Selman Designs, 9054 Bum Rd., Carthage, MO 64836; bselman@janics.com; bsd.domainvalet.com.
Dymond Modelsport USA Ltd., 683 N. Main St., Oshkosh, WI 54901; (888) 4FUN FLY; (920) 303-1100; fax (920) 303-2021; www.rc-dymond.com.
FMA Direct, 9607 Dr. Perry Rd., Unit 109, Ijamsville, MD 21754; (800) 343-2934; fax (301) 831-8987; www.fmadirect.com.
Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.
Hitec RCD Inc., 12115 Paine St., Poway, CA 92064; (858) 748-6948; fax (858) 748-1767; www.hitecrcd.com.
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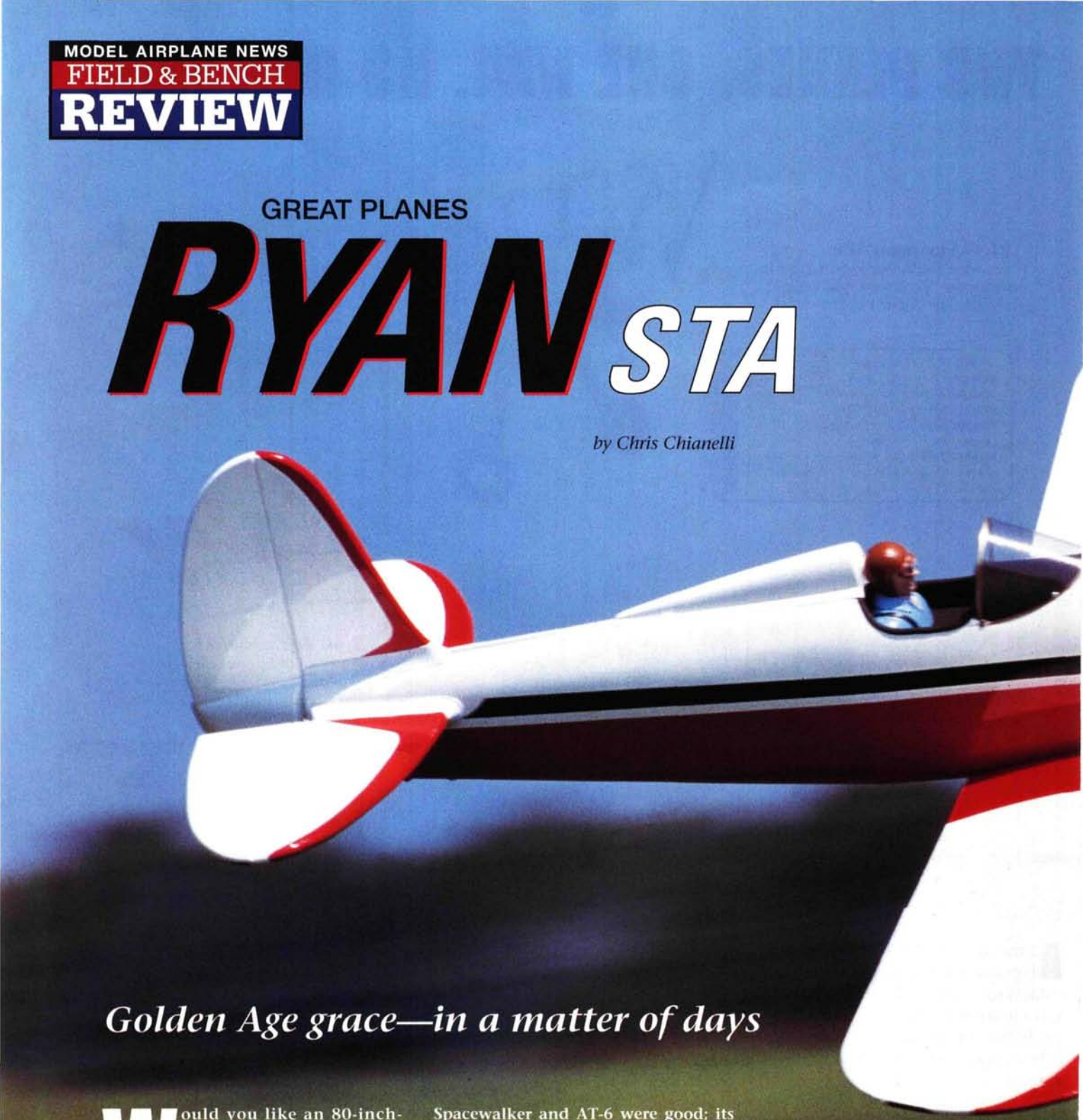
Sirius Electronics; distributed by Peak Electronics Inc., 12520 Kirkham Ct., #8, Poway, CA 992064; (800) 532-0092; www.siriuselectronics.com.
Sky Hooks & Rigging, 2206 Towne Blvd., Oakville, Ontario, Canada L6H 5H4; (905) 257-2101; fax (905) 257-0168; info@microrc.com; www.microrc.com.

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

GREAT PLANES

RYAN STA

by Chris Chianelli



Golden Age grace—in a matter of days

Would you like an 80-inch-wingspan, all-wood Ryan STA—one of the most beautiful aircraft ever made, in my humble opinion—in almost-ready-to-fly form? I know I would, and now we can! This ARF thing just gets better and better. The competition among ARF manufacturers to earn best "fit and finish" honors in the RC industry is on, and with its new Ryan STA, Great Planes Model Manufacturing Co. has become a major contender in the giant-scale ARF "weight class." It's the best ARF offering yet from that company. Its Spacewalker and AT-6 were good; its Ryan is excellent.

Today, it serves as an icon of the Golden Age era, and in its time—the late '30s—the Ryan STA was a favorite sport/stunt plane. Moreover, as an "STM" version, it also saw military service as a trainer (designated "PT-20"). It featured mixed construction: a metal fuselage and fabric-covered wooden wings braced with external flying and landing wires.

Great Planes accurately captures the essence of the STA's sleek majesty—all in wood, of course—with an IMAA legal ARF version of this historic aircraft. The fully sheeted balsa fuselage and painted fiberglass cowl give it a rounded, scale-like cross-section from nose ring to tail post. These two components, in particular, are fine pieces of work that exemplify the quality found throughout the kit.

THE KIT

In the ARF market, the quest for quality is reaching a fever pitch, and you, as consumers, are the beneficiaries. Some

of the most recent ARF kits offered by Kyosho, Yellow Aircraft and AirBorne Models are good examples of what I mean. The Ryan STA sits right up there with the best of these. When you get a new ARF home and find that the wing is precision-fit into its saddle and that the hold-down bolts line up exactly with the preinstalled blind nuts, you know you've purchased wisely. From the built-up control surfaces to the epoxy-coated engine box and firewall, you kind of feel you built the Ryan yourself—but, of course, you didn't!

The entire structure is made of high-quality balsa and plywood and covered with MonoKote. The cowl and wheel pants are fiberglass and painted to almost exactly match the MonoKote colors. Some Great Planes ARFs come with an ABS plastic cowl; having a plastic cowl on a giant-scale plane such as the Spacewalker I would consider to be a "miss." The Ryan's cowl, however, is not only well made in fiberglass, but it also has panel lines and rivet details molded in—a vast improvement. The headrest, stab- and fin-root covers and the lower rudder fairing halves are made of ABS plastic that's perfectly acceptable for these low-stress beautifying steerable tailwheel, is of good quality, and

SPECIFICATIONS

Model: Ryan STA

Manufacturer: Great Planes

Type: ARF scale

Length: 60 in.

Wingspan: 80 in.

Wing area: 1,002 sq. in.

Weight: 168.8 oz.

Wing loading: 24.25 oz./sq. ft.

Engine req'd: .61 to .91 2-stroke, .91 to 1.20 4-stroke

Engine used: O.S. 1.20 Surpass III w/pump

Prop used: APC 15x8

Radio req'd: 4-channel w/6 servos

Radio used: Futaba 6XAS

Fuel used: Wildcat 15%-nitro Premium Xtra

Street price: $349.99

Features: built-up, all-wood ARF covered with MonoKote; D-tube wing construction with capstrips; built-up control surfaces; painted fiberglass cowl and wheel pants; hardware, tank, spinner, wheels and tailwheel assembly included.

Comments: a finely crafted ARF that's on a par with the very best of them; highest-quality materials used throughout; very easy to assemble.

Hits

- Gorgeous scale appearance.
- Aerobatics capability with intermediate/trainer stability.
- High-quality execution.
- Excellent materials and parts fits.
- Superb slow-flight characteristics.

Miss

- No tailwheel mounting plate (see text).

you should feel confident in its use throughout. As I said, this is Great Planes' best yet.

ASSEMBLY

Great Planes' instruction booklets have been at the head of the class for some time now, and the Ryan's is no exception. The photos and diagrams leave nothing to the builder's imagination. The instructions are very detailed yet perfectly clear.

One area I thought a miss was the tailwheel-assembly mounting. The outer skin of a model should be made of high-grade, sandable (relatively soft) balsa, except for those areas in which something must be hard mounted, e.g., a tailwheel assembly. Soft balsa isn't hard enough to securely anchor tailwheel mounting screws. I even saturated the screw holes with CA glue to harden things up—no good; the screws just pulled out a larger plug of CA-impregnated balsa. I had to make a plywood tailwheel-assembly mounting platform, and that's what Great Planes should have done in the first place. After all, hard mounting locations are provided for the decorative ring bracing struts.

I slightly modified two other areas: the

FLIGHT PERFORMANCE

A big scale model of a Golden Age icon with a wing loading of 24.25 ounces per square foot! I ask you, what could be better? Just look at this beauty! And it flies just as well as its looks hint it might. I was slightly worried about the O.S. .120, since lousy weather right up to flight day had not permitted me to break in the engine at home as I usually do. Showing up for magazine-cover flight shots with an engine that has never even been started did not give me a comfortable feeling. All I can say is that the latest round of new O.S. engines I've run—the .91 Surpass II and this 1.20 Surpass III (both pumped versions)—have raised the bar on quality and reliability once again. I now believe, and I'm sure I'll get letters about this, that the new breed of 4-stroke has surpassed the 2-stroke in terms of reliability.

I primed the new engine at a high idle trim with the electric starter, went to low-throttle trim, added the glow power, hit the spinner with the starter, and the engine came to life at a slow idle. That's what a precision-fit gets you.

• TAXIING AND TAKEOFF

If you fly off grass, as I do, you might think about modifying the bottom of the wheel pants, as I did. Owing to the relatively high angle at which the Ryan sits on the ground, the bottom rear half of the wheel pants scoop up grass and dirt like a shovel. Enlarging the wheel opening on the bottom of the wheel pants—toward the rear—totally solved this problem for me (see photo above the specification box). With this grass-field fix, the Ryan has rock-steady ground handling—very controllable, even in a moderate crosswind, and very scale-like; in fact, everything this model does is very scale-like. Takeoff runs are straight, and the tail comes up rather quickly. The Ryan didn't show any tendency to ground loop. The effectiveness of all the control surfaces was immediately apparent right after liftoff.

• AEROBATICS

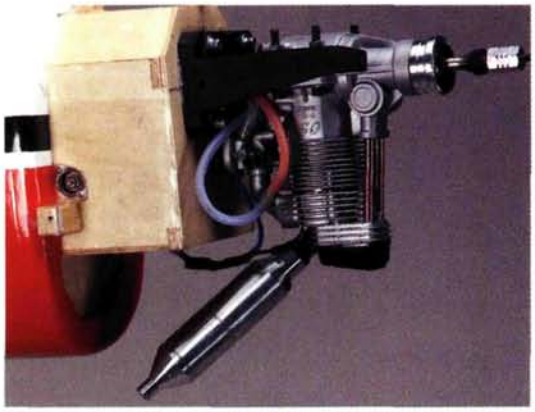
As I've already said, this one does everything in a true-to-scale way. Loops and rolls are very graceful, and stall turns are downright majestic; in fact, "majestic" is a good word to describe this model's flight characteristics all the way around. With the moderate control throws I initially set the plane up with, I wasn't expecting spin capability, but, lo and behold, the Ryan turned out a beautifully slow, and very scale-like, spin. With the CG moved ¼ inch rearward and some increase in the elevator throw, snaps were breathtaking. Even with the Ryan's semisymmetrical airfoil, inverted flight needs very little down input. Twisting this large model and its imposing wheel pants and fairings through the sky earns you a real beauty show.

• LANDING AND SLOW FLIGHT

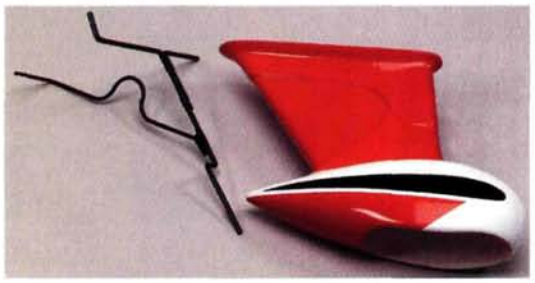
The Ryan, notwithstanding its aerobatic grace, has super slow-flight characteristics, and it lands like a perfect lady. You can really slow this one down. There's that 24.25-ounce wing loading, but be careful: with the large-diameter—15- to 16-inch—prop you're likely to have on this model and with the extra drag of those large wheel pants and fairings, this big bird slows down fast. You might even plop it down on the ground a bit too hard. I did, but no damage. Just keep a bit of power on until you're a few inches from touchdown and you'll be fine.

Keeping it pretty

I just couldn't bring myself to chop a huge hole in the side of the Ryan's cowl as the instructions suggest. Ruining the beautifully sleek lines of this Golden Age favorite would be a crime. To solve my dilemma, I ordered a 90-degree O.S. header (right) that only comes with a female end. To get the stock muffler and special-order header to match up, using a House of Balsa cutting disc, I cut off one of the threaded ends of the stock header pipe (left) to serve as a coupler. As you can see from the photo of the assembled exhaust, this simple setup keeps things beautiful by exiting the muffler out through the bottom where it belongs.



Inverted installation notwithstanding, the new O.S. 1.20 Surpass III runs extremely reliably, even with an initially rich setting for break-in. During 11 flights and two days of photo shooting, I never had a flame-out. Latest 4-stroke technology surpasses that of the 2-stroke in terms of dependability. With the needle still safely set on the rich side, the O.S. pumped out 9,600 to 9,700rpm turning an APC 15x8.



The three-piece landing-gear struts were up to the job of carrying this 10-plus-pound model. Love those fairings and pants!—so much so that I made silicone washers to protect the finish where the mounting screws contact the top of the fairings.

plywood aileron-horn mounting plate and the elevator pushrods. I thought the aileron mounting plate wasn't close enough to the ailerons' leading edge to obtain the proper control-linkage geometry, so I added a little more plywood plate in front of the existing piece—no big deal; I just wanted to get things just right. Great Planes opts for a dedicated servo and linkage system to each elevator half, and I think this is an excellent safety feature. The problem on my Ryan—and this may not be the case with yours—is that these thick, 4-40 rods didn't move freely in the preinstalled pushrod tubes. Since the model just barely edges over the giant-scale qualification line (having an 80-inch wingspan), is designed to fly at moderate speeds and has a dedicated linkage system running to each elevator half, I thought it prudent to switch to 2-56 pushrods to alleviate the binding.

Other than these changes, I built the Ryan exactly according to the instructions, and the assembly went very smoothly—a totally enjoyable experience.

POWER

I powered my Ryan with O.S.'s new fuel-pump-equipped 1.20 Surpass III, and what an engine it is! It's extremely reliable—inverted mounting notwithstanding—and very powerful. With the 1.20 Surpass III, I found myself flying the Ryan at ¾ throttle most of the time, and some of you won't feel you need all this power for your Ryan. For realistic performance and scale-like aerobatics, a strong .91 4-stroke or a sport .91 2-stroke will do quite nicely. I can't see anyone, however, coupling this historic beauty with anything but the sound of a 4-stroke. But, that's just me.

The kit comes with a good plastic spinner, but this plane deserves the precision and beauty offered by a Tru-Turn spinner. Although the one that's included is of good quality, putting a plastic spinner on this beauty would be like wearing bargain outlet shoes with fine, custom-tailored suit.

Radio equipment almost gets lost in the Ryan's cavernous balsa fuse. Hobbico's CS-71 servo with 80.5 ounces of torque was used for rudder, and two 42.6-ounce CS-55s were used on each elevator half. Futaba digital, low-profile S9150s servos with 80.5 ounces of torque were used for ailerons. All torque ratings are at 4.8 volts.

The covering was stripped from a spare left wing to show its high-quality lightweight construction.

CONCLUSION

You know; maybe someone more objective should have done this review. I'm very partial to Golden Age planes and, in particular, the Ryan STA. On the other hand, had Great Planes screwed things up and not adorned this historic beauty with the high-quality features it deserves, I would have been really upset about the mistreatment. Fortunately, this awesomely sleek icon of the Golden Age has been given a meticulous treatment.

Here you have a high-quality model that can be assembled in two days, has a large, striking scale presence and, when control throws are set conservatively, flies like an intermediate trainer. Increase those throws, and you have a Golden Age aerial Olympiad that's a mesmerizing show-stopper. What more can I say except go get one for yourself before they're on back order—and trust me, they will be. ✈

One of the Ryan's best angles; wow! I love this model. I just had to match the detailed fiberglass cowl with a Tru-Turn spinner and lightweight backplate. The included plastic spinner is good as far as plastic goes, but this special model deserves the best.

APC Props; *distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

Great Planes Model Mfg. Co., *P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.*

House of Balsa, *10101 Yucca Rd., Adelanto, CA 92301; (760) 246 6462; fax (760) 246-8769; www.mag-web.com/rc-modeler /hobnew/.*

O.S.; *distributed by Great Planes Model Distributors Co.*

Tru-Turn; *distributed by Romco Mfg., P.O. Box 836, South Houston, TX 77587; (713) 943-1867; fax (713) 943-7630; www.tru-turn.com.*

Ford Flivver

DYMOND MODELSPORT

by Vic Olivett

Back in 1926, Henry Ford had a dream. He had built cars for more than 20 years with amazing success, and he hoped that if he applied some of the same ideas to the world of personal aviation, the flying Flivver would become the Model T of the skies. Flying was just becoming accepted as a safe form of passenger transportation, but the idea of people flying their own planes the way they drove their cars was a bit optimistic; the Flivver did not catch on. Nevertheless, the plane was well designed, and though it never turned a profit, it has become a great subject for modelers. Now, modelers can experience the excitement of this Golden Age aerobat in ARF form with Dymond's superb 71-inch rendition of Henry Ford's dream machine.

The Dymond Modelsport Flivver designed to get you into the air with ve little time and effort. This ARF is complete built of balsa and plywood and is covere with blue and silver Ultracote, and it ha been hinged and painted. The kit includ a fiberglass cowl, landing gear with wheel prebent pushrods and epoxy-coated moto and tank compartments. Also included a the installed servo extensions for th aileron servos.

FUSELAGE ASSEMBLY

Assembly begins with engine installatio I mounted the O.S. .91 4-stroke with 8x3

SPECIFICATIONS

Model: Ford Flivver

Manufacturer: Dymond Modelsport

Type: standoff-scale ARF

Wingspan: 70 in.

Wing area: 840 sq. in.

Weight: 6.1 lb.

Engine req'd: .50 to .65 2-stroke; .65 to .90 4-stroke

Engine used: O.S. .91 4-stroke

Radio req'd: 4-channel with 5 servos

Price: $169

Features: balsa and ply construction; fiberglass cowl; covered in Ultracote; complete hardware package; control surfaces come hinged, and the paint and trim work is done. Aileron servo extensions are installed, and the kit comes with prebent pushrods, landing gear and wheels.

Comments: unique and nostalgic appearance; easy construction; excellent flight characteristics. With an O.S. .91 4-stroke, the plane has plenty of power for exciting scale aerobatics, but its airfoil produces pleasant slow-speed performance.

Hits

- Great-quality construction and covering.
- Scale flight performance.
- Complete hardware package.

Miss

- Inside rear of the fuselage is a tight fit for the pushrods.

A unique piece of aviation history in ARF form

machine bolts and blind nuts; the motor mount already has downthrust and right thrust built in. I placed the tank assembly on the flat tank floor just behind the engine firewall and used a thin piece of foam rubber to absorb the engine vibration. I mounted the tank using four small screw-hooks and rubber bands.

The cowl is made of good-quality fiberglass and must be custom-fit to the engine of your choice. After a few measurements and some careful cutting, the cowl fit very nicely over the engine. You also have to open areas for the muffler and the needle valve. The cowl runs back to the beginning of the turtle deck and covers the entire top front of the fuselage. Once you are satisfied with the fit, the cowl can be screwed into place.

The rear of the fuselage comes prepared for the vertical fin and horizontal stab. Both of these components are hinged and ready for final installation. On my model, the slots for the horizontal stabilizer and vertical fin were tight, and alignment was perfect. Remember to install the tailwheel in the rudder area before you install the vertical fin and rudder. Once you are sure of the measurements, you will have to mark the covering to be removed before final installation. Be careful not to score the balsa under the covering. This can cause a weak area in the stabilizer.

The pushrods included in the kit are prebent for the elevator and rudder. However, I did find that the pushrod clearance in the rear of the fuselage was tight. If left as installed, the elevator and rudder pushrods would have rubbed against each other. I corrected this problem by placing one servo upside-down in the servo tray. This gave the needed clearance and still left room for the receiver. To ensure that the throttle pushrod clears the fuel tank, mount the throttle servo on the outside of the servo tray. Now set the fuselage aside and check out the wing.

MAKING HISTORY AGAIN—ALMOST

In 1908, Henry Ford revolutionized the automotive industry with the introduction of the Model T. He forever changed the way Americans think of personal transportation. In the 1920s, he set out to do it again—this time, with an airplane. That plane was the Ford Flivver, the first working prototype of which was built on June 8, 1926. It had a wingspan of 21 feet, 9 inches and weighed just 320 pounds. It used a WW I-surplus 3-cylinder, 35hp Anzani engine to achieve a top speed of 85mph.

Though Ford never actually announced plans to mass-produce the Flivver, he campaigned heavily to convince the public that flight was a safe and practical means of transportation. Other Ford airplanes, such as the Tri-Motor—one of the first all-metal airplane designs and the very first plane to be built on an assembly line—became staples of the burgeoning commercial air-transportation industry. The Ford Motor Co. was among the first companies to be commissioned to carry airmail for the U.S. Postal Service.

The EAA has one of two surviving Ford Flivvers on display at its museum in Oshkosh, WI (photo courtesy of EAA 1995/Donna Bushman).

We'll never know whether the Flivver could have done for private aviation what the Model T did for the auto industry. After test pilot Harry Brooks, the only man ever to fly the Flivver (other than a single demonstration flight made by Charles Lindbergh) was killed in a 1928 crash in Flivver number 3, Henry Ford pulled the plug on the project. The worsening financial climate further restricted the Ford Airplane Division, and in 1933, it was shut down completely.

A couple of examples of the Flivver still survive today. And though never a commercial success, the design remains a charismatic and capable little airplane that hints at what might have been if bad timing and bad luck hadn't conspired against it.

WING ASSEMBLY

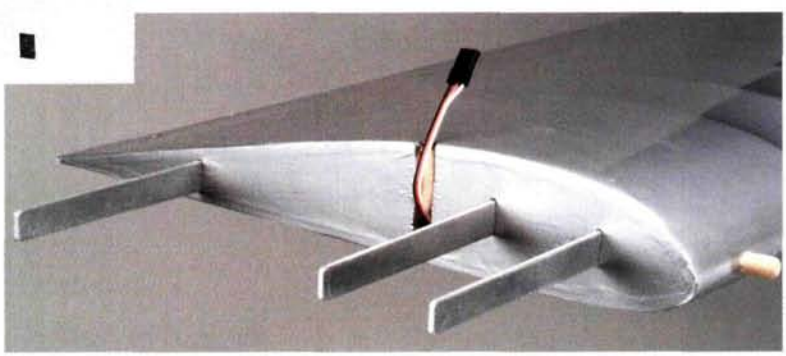
Dymond Modelsport did a great job on the wing, which uses three aluminum joiners. The wing has three pockets for the joiners and channels for the servo wires. Once the joiners are in place, the wing is very strong. By using this system, you can easily break down the wing for transportation and storage.

The wing comes with installed servo-extension wires that fit most of today's radios. I used Hitec HS 225 BBs, but any servo of similar size will work just fine. Once the servos are in place, check the length of the supplied pushrods with the clevises attached. The control horns can be fastened to the aileron using screws and a little CA for added insurance.

Now for the strange part: Dymond recommends that you fasten the servos into the wing pockets with glue. I have a problem with using glue on a servo. If it ever has to be replaced, you may damage the floor of the pocket. I suggest that you use a more conventional method of servo installation. A simple Y-connector completes the wing control system. The wing is attached to the fuse by rather large dowels in front and two ¼-20 nylon bolts at the rear.

The landing gear is prebent wire held in place by four standard straps and screws. Included in the kit are two large bal-

Above: the quality of Dymond's Ford Flivver ARF is obvious right out of the box. The model is constructed of balsa and ply, covered in Ultracote and includes hardware.



Right: three aluminum joiners hold the wing together solidly. Note the aileron servo extensions that come installed in the wings.

FLIGHT PERFORMANCE

When I showed up at the field for the Flivver's photo session, I took one look at this single-seat flying Ford, smiled and thought to myself, "This is my kind of airplane—a scale subject that's a wee bit on the strange side." The Flivver has a short and somewhat anomalous niche in history, with looks to match. Speaking of short, one thing that did concern me was the design's very short nose moment. If you keep an eye on balance and elevator control-surface throw, however, the Flivver turns out to be a very smooth flying, incredibly forgiving model. Then again, you have to try really hard to mess up the flight performance of a 71-inch-wingspan model that has a wing loading of 15.62 ounces per square foot.

• TAXI AND TAKEOFF

Except for possibly needing a bit more up-elevator to keep the tail down, the Flivver ground-handles much like the other tail-dragging sport planes I've flown. With its wide main-gear stance and tail-moment proportion, this one is well behaved while taxiing. The large-diameter wheels certainly help on a grass field, but Dymond didn't have to make them wide, too. As you can see from the photos, the full-scale plane had narrow wheels that were common to aircraft of the era. I think "the Fliv" deserves a more scale-looking set of wheels from a company such as Williams Brothers.

Once the elevator has been slowly neutralized from full up during takeoff roll-out, the tail comes up quickly, and the model is easy to keep in a straight line with rudder application. With a wing loading of less than 16 ounces per square foot, the Flivver breaks ground in a very scale-like manner at about ½ to ¾ throttle. Although the model balanced perfectly with the O.S. .91 Surpass II, it simply does not need all this power.

• HIGH SPEED AND AEROBATICS

With its fat Cub-like airfoil, speed is not the Flivver's thing, nor should it be. During all the flights that day, I never used a prop that had more than a 6-inch pitch. For most flights, a Master Airscrew 14x6 served quite nicely. The most enjoyable part of this model is the very scale-like demeanor it demonstrates throughout all flight modes. Rolls, spins and loops are executed with full-scale grace. Spins have a slow majesty to them, almost as though they're in slow motion. Power-off down-legs are even accompanied by that full-scale sound of wind rushing over the airframe. Considering the airfoil in play, I was quite surprised at the relatively small amount of down-elevator input that was needed during inverted flight. The most pleasant surprise, however, was how well the Flivver tracked at both low and high speeds. It's just so much fun to fly. Because of the airfoil, I fully expected down-elevator trim to be needed as throttle was applied and speed increased, but this didn't seem to be the case. With the O.S. .91's power and the 6.1-pound flying weight, I'm sure this model could perform top-rudder maneuvers, but I didn't try any. I felt that a 1927, 3-cylinder Ford Flivver doing a high-speed, knife-edge pass would look a little silly. Then again, silly can be a state of grace.

• SLOW FLIGHT AND LANDING

When it comes to slowing things up for that final approach, with 71 inches of wingspan and less than 16 ounces of wing loading, this model has a Reynolds factor that kicks butt in terms of slow-flight characteristics. Simply put, the Flivver is your best friend during slow flight. Unless you slam it a bit too hard, it touches down and stays down on landing. I don't know what else to add here; its slow-flight characteristics are fabulous.

• CONCLUSION

If you like something that's nostalgic, has a quirky character all its own and flies wonderfully, get this model. It does not need the .91 Surpass II, that's for certain. Any .60 4-stroke, and I do mean any—even if it's 15 years old—will fly this design just fine. Any modern-day, powerful, .50-class 4-stroke will also do nicely. That's the nice thing about a model of this size with a wing loading this low; you can experiment all you want.

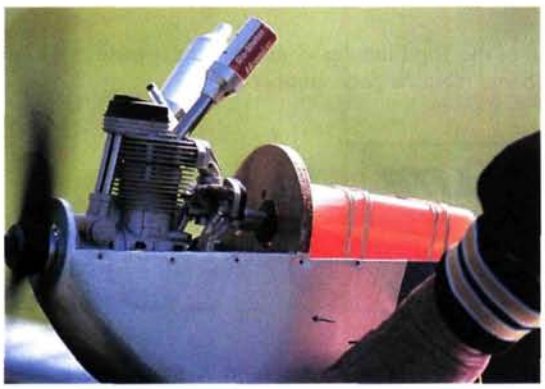
Let me put it this way: Dymond's Ford Flivver is the type of model you put on floats. And in my humble opinion, that's the ultimate proof of how much fun a model can be. —*Chris Chianelli*

loon-type wheels along with the wheel collars. The 3½-inch wheels really give the Flivver a Golden Age look.

When the Flivver is complete, it looks somewhat out of proportion; the massive wing on this little, short, stubby fuselage gives the Flivver a unique profile, but it remains true to the original. With all of the components in place, the Flivver should balance without any additional weight. For the final setup, Dymond recommends that the control throws be set rather liberally; elevators, 1½ inches up and down; ailerons, 1 inch up and down and the rudder at 1 inch left and right.

FINAL THOUGHTS

The Dymond Modelsport Flivver is a neat-looking model and can be ready for flight in just a few hours. In today's busy world, that is a big plus. The quality of the workmanship is very good on both the construction and the Ultracote covering. The result is a model with a distinctive look that flies like a dream. ✈



An O.S. .91 4-stroke provided plenty of grunt for the Flivver. The wing's airfoil limits the top speed somewhat, but the power really comes in handy for scale aerobatics. Plus, it sounds great.

Dymond Modelsport USA Ltd., *683 N. Main St., Oshkosh, WI 54901; (888) 4FUN FLY; (920) 303-1100; fax (920) 303-2021; www.rc-dymond.com.*

Hitec RCD Inc., *12115 Paine St., Poway, CA 92064; (858) 748-6948; fax (858) 748-1767; www.hitecrcd.com.*

Master Airscrew; *distributed by Windsor Propeller Co., P.O. Box 250, Rancho Cordova, CA 95741; (916) 631-8385; fax (916) 631-8386; www.masterairscrew.com.*

O.S.; *distributed by Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.*

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YELLOW AIRCRAFT INTL.

CAP 232

by Roger Post Jr.

In recent years, the ARF aerobatics market has really taken off; the number of Extra, Sukhoi, Edge, Giles, CAP and other aerobats now available is mind-boggling. The 20-percent CAP 232 from Yellow Aircraft Intl. fits into this category, and its quality is a cut above the rest.

Inside the box, I found a solidly built, light balsa and ply airframe that was expertly covered. A check of the wing and tail surfaces revealed no warps or twists, and the fuselage was as straight as an arrow. The firewall is "keyed" into the fuselage sides and bottom to ensure that it stays connected to the front of the plane, and all of the exposed wooden parts have been fuel-proofed. The fiberglass cowl and the wheel pants are beautifully painted, and the vacuum-formed canopy's trim color is painted as well.

Yellow's CAP 232 ARF comes nicely appointed with a complete, high-quality hardware package. Note the weight-saving measures in the construction of the wing, aileron and elevator surfaces. These contribute to excellent flight characteristics.

The hardware package is complete; it includes a heavy-duty tailwheel bracket, engine mounts and landing gear of wire and aircraft-grade aluminum. All you need to complete the CAP is a 4-channel radio with five servos, an engine, a propeller, two servo extension wires and the necessary tools and adhesives.

WING ASSEMBLY

Start by mounting the servos and trial-fitting the servo hatch covers into the wing halves. I found the openings too

SPECIFICATIONS

Model: CAP 232 ARF (60-size)

Distributor: Yellow Aircraft Intl.

Type: 20-percent sport-scale aerobat

Wingspan: 60 in.

Wing area: 674 sq. in.

Airfoil: symmetrical

Weight: 6 lb., 10 oz.

Wing loading: 22.55 oz./sq. ft.

Length: 52.7 in.

Engine req'd: .60 to .80 2-stroke, or .70 to .90 4-stroke

Engine used: Thunder Tiger F-91S

Propeller used: APC 13x10

Radio req'd: 4 channels with 5 servos

Radio used: JR 10X

List price: $286

Features: major components are covered and trimmed with film; light balsa and ply airframe construction; painted aluminum landing gear; painted, clear, vacuum-formed canopy; painted fiberglass cowl and wheel pants; detailed, fuel-proof decals; 27-page instruction manual; complete hardware package.

Comments: Yellow's CAP 232 is a superior-quality ARF. It includes a complete hardware package, and the covering job is outstanding. A few items needed minor modifications, but overall, this is a fun model to build and fly.

Superior quality ARF with performance to match

Hits

- Strong construction design.
- Scale appearance.
- Great flyer with super handling qualities.
- Exceptional quality for an ARF.

Miss

- Forward servo rail inhibits fuel-tank installation.

FLIGHT PERFORMANCE

At the field, I fired up the Thunder Tiger F-91S engine and tuned it for the conditions so the muffler emitted a nice smoke trail at full throttle. I selected low rates on the three dual-rate switches and taxied into position. The field's grass was a little too high for the CAP to taxi properly, but I'm sure this wouldn't have been a problem if I had removed the wheel pants.

• TAKEOFF AND LANDING

I gradually applied full power to overcome the drag of the grass and added some right rudder to keep the track straight. Acceleration with the APC 13x10 propeller was very quick—even with the high grass. On liftoff, the CAP pitched up and climbed quickly. I reduced the throttle to ⅔, and to keep the climb-out under control, I added some down-trim and some left-aileron trim. I tried the high rate on the rudder for the next takeoff. With this change, less rudder input was required to control the ground track.

At a safe altitude, I reduced the throttle and added some more down-trim. Even at ½-throttle, the CAP really moves, so make very minute control inputs until you are comfortable with its flight characteristics.

To land, I used the low rates and set up a downwind pattern with a ¼-throttle setting. I used the long approach to bleed off the excess approach speed. When the 232 was right over the threshold, I chopped the throttle and let the model glide to the runway. I flared it a few inches off the ground, and it touched down smoothly. On the second landing, I noticed that I was almost running out of elevator for the flare. A switch to the high rates and careful elevator-stick input cured that.

• LOW-SPEED PERFORMANCE

The CAP 232 will fly quite slowly and retain all of its controls right down to and through the low-speed stall. The stall had a very gentle forward fall, and the wing did not drop. To recover, add a little power and release the elevator.

• HIGH-SPEED PERFORMANCE

At full power, my CAP was able to cover the 200-foot runway in a couple of seconds. A power-on stall was basically impossible; the CAP just kept climbing. There wasn't any control-surface flutter during straight and level high-speed flight. Even at ½-throttle, a dive built up a good head of steam; I did not try it at full throttle.

• AEROBATICS

This is limited only by your imagination and your piloting skills. The Yellow Aircraft CAP 232 will do anything, including 3D maneuvers: Waterfall, Elevator, Harrier, etc. As for the standard loops, rolls and spins, the CAP does them effortlessly. Its wide fuselage side produces great knife-edge performance, and only slight elevator and aileron trim changes are required to keep it from rolling and pitching.

small for standard-size servos, so for the aileron servos, I substituted two JR 9011s, which fit perfectly. Snake the aileron extension wires through their guide tubes, and screw the servo hatches into place; join the wing halves per the instructions.

ENGINE AND COWL

Follow the instructions for attaching the engine mounts to the firewall and for drilling the engine bolt holes; temporarily glue the engine to the mounts to make the process easier. After you have trimmed the cowl to fit over the engine and muffler, mount it on the fuselage. Do *not* drill the bottom two holes (one per side) as they appear in the illustration; as drawn, their locations would interfere with the wing. When the wing's epoxy has cured, attach the wing to the fuselage; you may have to trim the wooden "key" in the wing's forward hold-down area. Mark a position for the remaining two cowl holes, remove the wing, and finish mounting the cowl.

Now, reattach the wing; note the lack of space between its center section's trailing edge (TE) and the fuselage's corresponding area. When you apply the wing-joint fiberglass tape, do not wrap it around the TE.

I recommend that you assemble the fuel tank but do not install it right away. You need to work with the landing-gear blind nuts inside the fuel-tank area before you permanently affix the fuel tank. Also, the forward servo rail inhibits fuel-tank placement, so you will have to remove it carefully prior to installing the tank.

Before you install your engine, check the throttle arm's position to see if the linkage will interfere with the fuel tank. I had to turn both the arm and the carburetor 180 degrees to avoid interference. Note that the firewall is "keyed" into the bottom plywood piece. I used Thunder Tiger's F-91S and, by putting the muffler underneath the engine, I did not have to carve up the cowl.

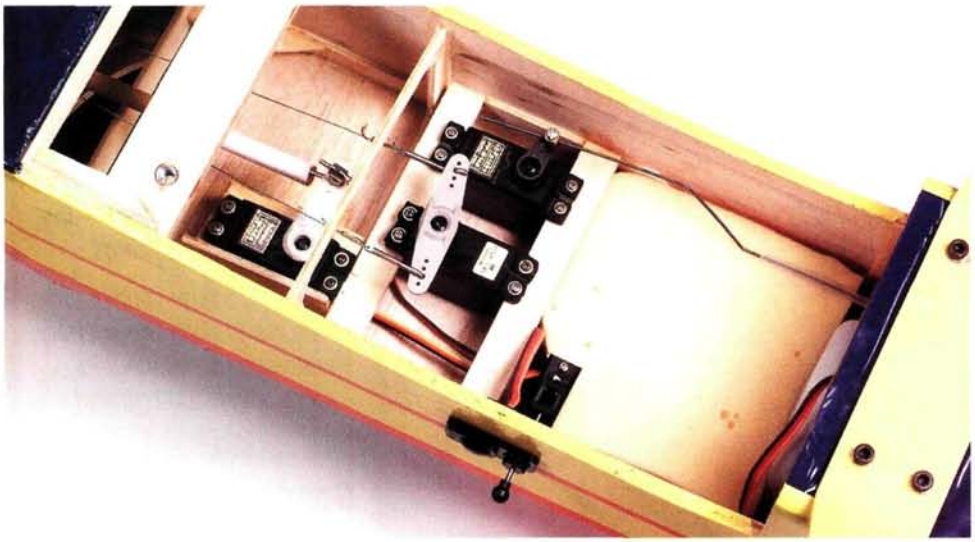
HINGES

I used Great Planes' thick CA hinges instead of the ones supplied. Trial-fit the aileron hinges into place and check them for smooth motion before you glue them. Also, it is wise to install the aileron control horns before permanently attaching the ailerons to the TE.

Attaching the wing to the fuselage is very simple and straightforward. Carefully measure to ensure that the wing is in the correct position, drill the holes with the required bit size and then enlarge the wing's bolt holes with a ¼-inch drill bit. After you glue the wing-bolt plates into place, the wing assembly is complete.

STABILIZER AND GEAR

There is nothing difficult here; just make sure that the two surfaces are properly aligned before the epoxy cures. While you wait for this, assemble the main landing gear and the tail gear; make sure that the wheel-pant angles match. After you have drilled the mounting holes in the wheel pant's lite-ply pieces, epoxy the pieces into place and remount the wheel pants to the gear using the provided hardware. This will clamp the lite-ply to the inside of the wheel



The Z-bend permits the throttle cable to connect to the servo arm without placing any pressure on it. The elevator servo was relocated to yield a straight-line connection for the pushrod; this also lowered the pushrod so it would not interfere with the rudder's pull/pull cables.

pants as the epoxy cures. After it has cured, remove the wheel pants and reinstall them with the wheels and recommended washers. Do not install the gear to the fuselage at this time.

After you have trial-fit and then installed the control horns, you can permanently hinge the rudder and elevators in place, leaving a 1/32-inch clearance gap between the counterbalance and the stabs. I noticed that the elevator halves did not conform to the taper of the aft fuselage, although this won't affect the model's flight characteristics.

After you have drilled the four holes for the main gear, take a short piece of tape and wrap it around your index finger, sticky side out. Stick a blind nut on the tape right over your fingerprint and slide your finger inside the tank area. Position the landing gear, slip a bolt through the hole, and start threading the bolt into the blind nut. Repeat this three times, and then tighten the bolts to pull the blind nuts into the wood.

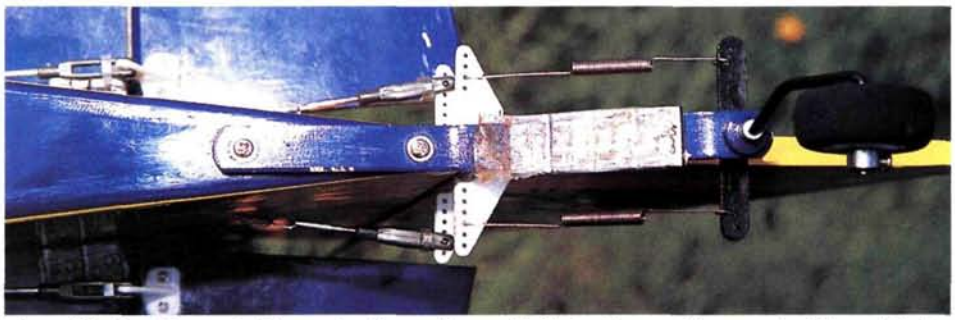
Install the tail gear according to the instructions with the two supplied screws, and connect the tail-gear horn to the rudder horns with the springs. Tape the rudder into its center position before you attempt to install the springs. Cut off any excess wire that sticks out.

SERVO LINKAGE

I installed each of the three servos and linkages individually. The throttle-linkage drawing shows the linkage bending at a very awkward angle that looks as if it will interfere with the fuel tank. Since I changed the throttle-linkage position earlier, I ran the Nyrod in a straight line through the firewall and the two inside plywood formers. You will, however, need an extended bit to drill through all three pieces. Once the throttle linkage is in place, you can install the fuel tank permanently and glue the forward servo rail back into position. To bring the throttle linkage up to the servo arm, I formed a large Z-bend in the linkage.

I then installed the rudder servo in the center and made up the pull/pull cables. To eliminate the slight rudder "play," I crossed the pull/pull cables. To prevent the cables from hitting each other in the aft fuselage, I placed one of the cable's Z-couplers on top of the servo arm.

Rather than use the off-center elevator servo with the Y-shaped elevator pushrod, I made a few changes to improve symmetry. First, I bent the end of one of the pushrod's threaded rods to match the drawing and placed it in position in the dowel. I then bent the second threaded rod at a slightly shorter length so when it was installed in the dowel, the threaded-rod ends lined up evenly. Second, instead of making a slight outward bend in each rod, which forms the Y, I bent them out farther, installed the pushrod in the fuselage and then bent the wires back in to meet the elevator control horns. This, combined with clearing some of the wood around the exit slots, provides more upward elevator throw and eliminates pushrod binding. I also installed the elevator servo aft of and slightly lower than the rudder servo. This allowed the elevator servo arm to line up with the center of the fuselage.



The pull/pull cable-control horns for the rudder and tailwheel assembly are set at the rudder's leading edge. Because of where I placed the battery, two ounces of tail weight were required to balance the model.

FINISHING TOUCHES

Tape the canopy into place and then drill its six mounting holes. As with the cowl, use the supplied lite-ply pieces to back up the holes drilled into the balsa. I positioned the CG at 4½ inches. I had anticipated needing nose weight, so I placed the battery under the fuel tank. Don't do this! I ended up using two ounces of Great Planes' stick-on weights in the tail to achieve the desired balance. I then set the travel throws per the instructions and added the decals.

This is a fine-quality ARF; you would be hard-pressed to find a better one among .60-size aerobatic models. Minor problems in the instruction manual notwithstanding, the kit itself was a joy to build and fly. This is a wonderful plane that you can enjoy for a long time.

***APC Props**; distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

***Great Planes Model Distributors Co.**, P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.*

***JR**, distributed by Horizon Hobby, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511; www.horizonhobby.com.*

***Thunder Tiger USA**; distributed by Ace Hobby Distributors, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037; (660) 584-7121; fax (660) 584-7766; www.acehobby.com.*

***Yellow Aircraft Intl.**, 203 Mass. Ave., Lexington, MA 02420; (781) 674-9898; fax (781) 674-2288; www.yellowaircraft.com.*

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

SPECIFICATIONS

Model: Mirage 2000-5

Manufacturer: WattAge

Distributor: Global Hobby Dist.

Type: sport-scale electric pusher

Wingspan: 20 in.

Wing area: 140 sq. in.

Weight: 15.7 oz.

Wing loading: 16 oz./sq. ft.

Motor: Ferrite 400 (included)

Prop: APC 6x3 (included)

Battery: 8-cell 600mAh pack (included)

Flight time: about 5 minutes

No. of channels: 3 (ESC, elevon right and left)

Radio used: Hitec Focus III transmitter w/ Hitec 535 receiver and JR 241 servos

Street price: $69

Features: molded-foam and vacuum-formed parts, pusher design with elevon control, prewired motor and ESC included.

Comments: the parts fit is excellent, and the plane takes less than a day to assemble. The Mirage is a really fast, fun model to fly.

Hits
- Well-made parts.
- Looks great in the air.
- Easy to fly for anybody already used to an aileron/elevator model.

Misses
- None found.

WATTAGE

Mirage 2000-5

by Jef Raskin

To my eye, there have been only a few truly handsome jets. The Douglas A4D Skyray comes to mind, as does the North American F86 Sabre and a handful of others from the American stable. From overseas, the Saab Viggen is a favorite; and then there's the subject of this review—a blend of classic wing and fin shapes that harmonize as smoothly as good wine and cheese: the Dassault-Breguet Mirage 2000-5.

WattAge, distributed by Global Hobby Distributors, put together a foam semi-scale model that successfully captures the spare lines of this supersonic delta. The wing and fin molding is exquisite, with sharp trailing edges and a smooth finish. The foam is complemented by a few vacuum-formed components, such as the nose and tail cones and the canopy. Up to now, I would have said that vacuum-formed parts never fit quite right, but the Mirage's engineering is excellent, and everything went together perfectly. Except for a few crucial points that I will mention, the clear and detailed manual tells you all you need to know. The section on motor maintenance is exceptionally good.

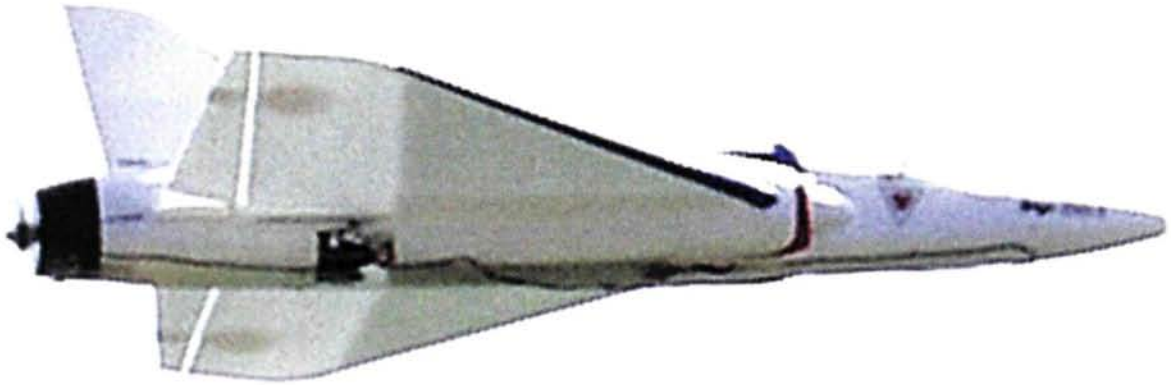
FLIGHT PERFORMANCE

To quote the manual, the Mirage "is quick and not suitable for inexperienced pilots." When you pour on the coals, this very low-drag model moves so fast that you will need a good-size field. Because it doesn't have landing gear, look for a place with flat, grassy expanses for landing. Fortunately, deltas slow down pretty well and have very forgiving stall characteristics.

• TAKEOFF AND LANDING

The Mirage has to be hand-tossed for takeoff. Given its tiny propeller that looks like and is as sharp as the blade from a blender, you should launch it with the motor off, and turn it on only after it has left your hand. The prop is a direct-drive APC 6x3 prop on a 400-size motor, and it spins fast enough to run a dentist's drill. Be careful: the prop will pass mighty close to your hand and head as you throw the model. Its "Coke-bottle"-shape fuselage, characteristic of supersonic craft, makes it easy to grip right under the CG. It requires a fast, hard, very slightly upward launch. Once the model has cleared the thrower's hand, the motor is turned on and the plane climbs away quickly, gaining altitude at a tremendous rate.

Deltas don't like to stall, and you can come in nose high. A smooth grassy area is a must, if the model is not to tear itself apart on landing.



Jet performance in a park flyer

ASSEMBLY

Building is easy and takes less than a day. Put in a few, supplied wooden plates, trim some vacuum-formed parts (the trim lines are clearly marked), hit the parts with a bit of paint, and glue on the wings. Then install the radio gear, and top the project off with the fin and decorative stickers. The basic airframe is quite light, and had I not been reviewing the model as designed, I might have tried it with a Jetex or other rocket engine. The battery and motor make up most of the weight. You have to solder the motor leads to the controller leads. Foam-compatible, water-based acrylic paints worked just fine and made the job worry-free. To make it easier to keep an eye on the radio components, I didn't paint the transparent bottom cover. You don't notice this omission in the air.

The manual tells you to mount the servos parallel to the centerline and then bend the linkages. It was much easier and sturdier to angle the servos outward, and to aim the control horns slightly inward, and thus get a strong, easy-to-build, dead-straight linkage run. Two tips: use some epoxy to make sure that the control horns stay put, and cut off the bottom arms to the servos so that they will be less at risk of striking something on landing.

For transmitting, I used a Hitec Focus III 3-channel single-stick AM radio; it has exactly what this model needs: aileron/elevator mixing, servo-reversing and throttle control. I used a Hitec 535 receiver and a pair of JR 241 servos. The servos weigh only 0.32 ounce each but have tons of power.

There aren't a whole lot of parts needed for this plane. In the bottom row are the 400-size motor, the 6x3 APC prop, an 8-cell 600mAh battery pack, a receiver and two servos, the WattAge ESC and the linkages. Above that, left to right, are the wings (only the leading edges are shown), the fin, the motor mount, charging connector and servo parts. The fuselage is at the top. On the right are the manual and stickers.

• NORMAL FLIGHT

In its stock configuration, the Mirage is a pussycat; it's gentle and purrs along. With the extended ailerons, it is easy to fly for an elevon model, but turns are crisper. Stalls are nonevents. Duration is over 5 minutes with Ni-Cds; more than adequate for a hot model. Use of NiMH batteries would nearly double this time!

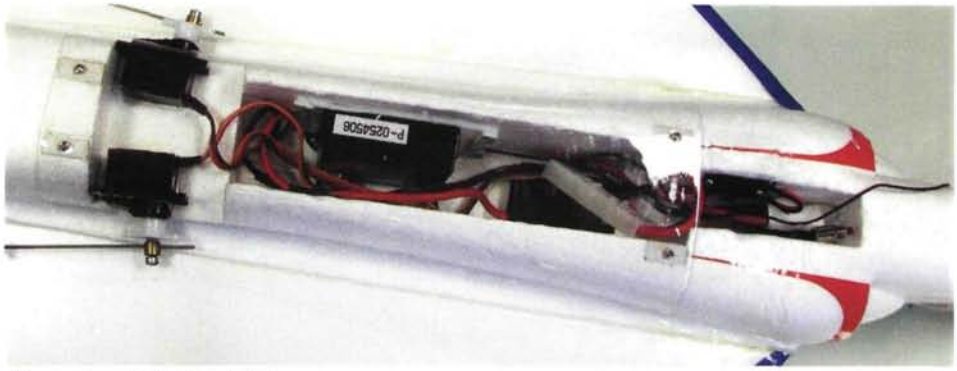
• AEROBATICS

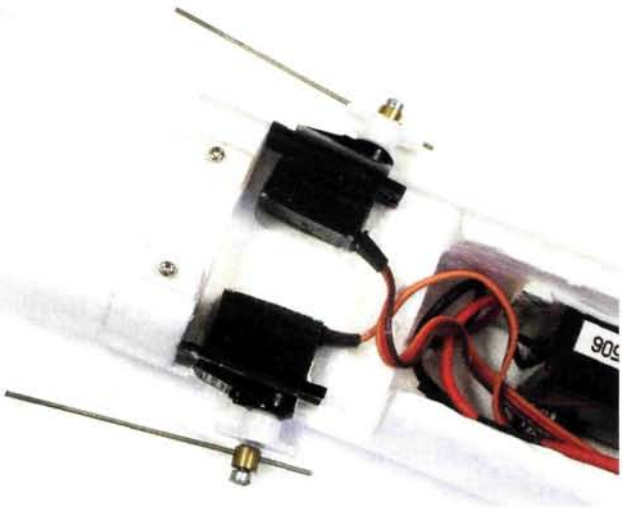
Standard 3-channel aerobatics are readily performed. Inverted flight is labored unless you make the aileron mod described in the "Making the Mirage fly even better" sidebar.

MAKING THE MIRAGE FLY EVEN BETTER

Though this model flies well when built exactly according to the instructions, the "spoilers" seemed to me to be an aerodynamic oddity. So I took them off, extended the ailerons to the wingtips and, without any change in adjustment, found that the Mirage 2000 flew better and had a much cleaner roll—needing far less push on the stick to keep it axial. Inverted flight could be made at a lower throttle setting. Here's the mod: before you cut out the ailerons, extend the V-groove in the bottom of the wing to the wingtip. I used a ruler and a sharp hobby knife. Then cut the aileron free on the inside edge only. I had to add a piece of reinforcement because I built the plane stock initially. It would not have been necessary, if I had followed my hunch and made this mod at first.

The Mirage gets a handling boost if you do not attach the clear "spoiler" tabs provided, but instead extend the aileron groove on the bottom of the wing all the way out to the wingtip, as shown here. Because I first built the ailerons stock, I had to add a paper stiffener to reattach the tip aileron, but this is not necessary if you haven't already cut the aileron free at the tip. The top skin of the wing is the hinge, but if you accidentally cut through it, a piece of tape will fix the damage.





Above: I used double-sided foam tape to hold everything in place. The plane was balanced by moving the receiver back and forth. The battery connector is stuffed under the plastic cover for flight, pulled forward and out for charging. Right: by tilting the servos slightly outward and the control horns slightly inward, you can achieve the best linkage of all: dead straight. I used servo-arm connectors to make adjustments especially easy. Note that I left the bottom cover clear. For better scale appearance, paint it white, as the instructions recommend.

The thoroughness of the manual fades toward the end. It is very hard to find a place to mount the radio switch and the motor-enable button, and the manual isn't of any help. The antenna is also a difficulty; the usual practice of trailing the antenna from the fin won't work because it will get sucked into the propeller. I ended up taping the antenna to the fuselage and wing and made sure to check range before flight, both with power on and power off.

The manual also mixes Metric and English measurements, as in "If you have more than 2mm up-elevon, move the battery pack forward ¼ inch." The spoilers were designed to make adjusting the model less critical. You may want to do as I did and fly the model in stock configuration first. I cycled the battery five times on my SR Smart Charger/Cycler, and on each charge, it got a larger mAh rating until it reached its advertised capacity. By the end of Saturday, I had finished the model, and I went to sleep hoping that the next day would be good flying weather.

AT THE FIELD

Sunday dawned clear, warm, calm and sunny. At the field, my son Aza offered to take the model up a hill so that I'd have more time to make adjustments before it hit the ground. A nice hill can be a big help for that nerve-wracking first flight. Aza gave it a smooth, fast and level toss, and I fired up the motor. The plane is powerful. It will climb forever at a 45-degree angle, and it flies like a jet! With the recommended balance point, throws and initial setting, the Mirage required no adjustments whatsoever. While a bit speedy for a model of its size, the model is very tame and easy to handle. The glide is steep but slow, and the power-off stall, even with the stick full back, never happens. The plane just mushes ahead on an even keel, maintaining aileron control. This makes it very easy to land, and even my first landing was perfect.

Rolls are slow with the recommended throws. Inverted flight, due to those plastic tabs, requires full power, but smooth, realistic inverted circles are easy. The plane will pick up incredible speed in a dive, and a fast pass across the field goes by at a scale 1,000mph.

All in all, the Mirage 2000 sport-scale jet model flies well, looks and moves realistically in the air and is easy to put together. I'd say that WattAge has a winner.

***Hitec RCD Inc.**, 12115 Paine St., Poway, CA 92064; (858) 748-6948; fax (858) 748-1767; www.hitecrcd.com.*

***JR**; distributed by Horizon Hobby, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511; www.horizonhobby.com.*

***SR Batteries Inc.**, Box 287, Bellport, NY 11713; (631) 286-0079; fax (631) 286-0901; www.srbatteries.com.*

***WattAge**; distributed by Global Hobby Dist., 18480 Bandilier Cir., Fountain Valley, CA 92708; (714) 963-0133; fax (714) 962-6452; www.globalhobby.com.*

HORIZON HOBBY

SOARSTAR

A great-flying introduction to RC

by Gerry Yarrish

The success of Speed 400-type electric motors and new miniature RC systems has paved the way for easy-to-fly, molded-foam, electric-powered models. The Soarstar, distributed by Horizon Hobby Inc., has the proven foam wing and pod-and-stick fuselage layout and uses a pusher prop for power. Because of its slow and stable flight characteristics, the Soarstar makes a good sport model and an excellent and relatively inexpensive trainer aircraft, and it was the perfect first model for my 10-year-old daughter, Rebecca.

FLIGHT PERFORMANCE

The Soarstar is a lightweight, fly-in-calm-weather model that's just perfect for flights in early morning or just before dusk. The geared 380 motor has enough power to handle some gusty conditions, but the model gets knocked about fairly easily; this is what park flying is all about.

• TAKEOFF

The Soarstar has plenty of power to take off from the ground, even off a grass field. Climb-out is slow but steady, and with just a touch of up-trim and a touch of right, it will fly all by itself to altitude. Once at a safe height, throttling back to ½ power allows the model to loaf along looking for thermals.

• LANDING

After the model has used up its battery charge and can no longer climb at full throttle, it's time to land. Throttle back and let it glide in using small bursts of power to control the rate of descent. Just before the model touches down, pull back on the stick to flare, and the model will land with almost no rollout at all. With some charge left, you can easily do touch-and-go's, but you must do them into the wind.

• AEROBATICS

If you really push it, the Soarstar can do steep banking turns and a mild wingover with enough speed on the entry. The most exotic thing you're going to be able to do is a loop, but do it right away while you have a fresh charge on the battery. If you want to do a roll, you'll have to settle for the barrel variety. This is absolutely fine, as the model is not designed for such maneuvers. The model is very happy just being easy to fly.

SPECIFICATIONS

Model: Soarstar

Distributor: Horizon Hobby Inc.

Type: slow park flyer

Wingspan: 36 in.

Length: 36 in.

Wing area: 403 sq. in.

Weight: 1 lb., 5 oz.

Wing loading: 7.59 oz./sq. ft.

Power: geared 380 electric motor (included)

Prop used: 8x4-inch pusher (included)

Radio req'd: 3-channel (rudder, elevator and throttle)

Radio used: Hitec Focus II w/two HS 85 servos

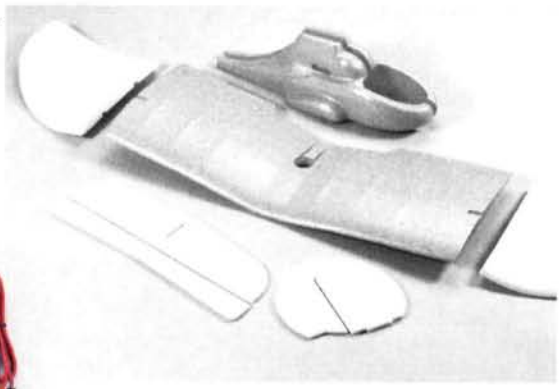
Price: $139.95

Comments: the Soarstar is a molded foam and wood pusher design that is very easy to build and fly. It comes complete with everything you need to finish the model except a 3-channel radio. The kit also includes a DC battery charger.

Hits
- Easy to build and fly.
- Surprisingly strong for a foam model.
- Complete package.

Miss
- Instructions do not indicate the correct CG (it should be between 3.5 and 3.75 inches back from the leading edge of the wing).

Right: the fuselage halves, 3-piece wing, fin rudder, horizontal stabilizer and elevator are the nine foam pieces that make up the Soarstar. Below: the kit comes with a complete power system, including a motor, prop, ESC, battery and even a charger. The wiring is already done; just connect the components and go.



THE KIT

The Soarstar has nine molded-foam parts, including the fuselage pod halves, a 3-piece wing, the rudder, fin, elevator and horizontal stabilizer. Also included in the kit are a spruce tail boom (stick), a few molded plastic fairings, wheels, hinges, dowels, basic hardware and wooden pieces used to join the wing panels. Completing the package are an 8-cell, assembled geared SC and battery ch need only a 3-cha 5-minute epoxy, aper, needle-nose p h bit and a small

The instructions are straightforward, and with dad's supervision, Rebecca had no trouble assembling the Soarstar. We used epoxy to join the wing panels and fuselage pod halves, and foam-friendly CA worked just as well to attach the hinges. Do not, however, use any type of CA accelerator, as this will quickly dissolve and weaken the foam.

RADIO INSTALLATION

We used a Hitec Focus II transmitter, which comes with two HS-85 servos; these fit into slots molded into the sides of the fuselage pod. Small wooden blocks must first be epoxied into the slots so the servos can be screwed into place. You could simply epoxy the servos into the slots, but this would make it impossible to remove them without damaging the model. The elevator and rudder-control horns are simply glued into place on the control surfaces and, so far,

My first real RC airplane

My dad builds and flies RC airplanes and has been taking me to the flying field ever since I was a little kid. I like to go because I have fun with my friends there.

My dad brought home a model called the Soarstar for me to build. He and I worked together for a couple of weekends to put the model together, and he installed a 3-channel Hitec Focus II radio in the model for me. The Soarstar is really easy to build; it is made mostly of foam and has a wood stick to join the tail to the body. The wing is held on with rubber bands and a dowel that is epoxied to the top of the body. The electric motor that powers the model sits on top of the wing and pushes the model forward. I like this because the prop is in the back, and it is really hard to break if I crash-land the model. So far, I haven't done that because my dad is a good teacher. After a few more lessons, I will be able to take off and land the Soarstar all by myself.

I like how the Soarstar flies because it is easy to keep it going the way I want it to. After my dad hand-launches the model, he gives me the radio and I do all the flying until the battery begins to die. Then I circle the model down until it is in front of me, and I keep the nose up a little and let it land. I always try to keep the model upwind so it won't get blown away from me. This is the hard part, and I always try to remember it. I also try not to fly over the pits.

A couple of times, the Soarstar hit the ground really hard and we had to put it back together with Elmer's glue. My dad and I just tape the parts back together until the glue is dry, then the model is ready to go again. One time, the rudder broke and we fixed it with some glue and a little piece of fiberglass cloth. If you know a kid who would like to fly an RC airplane, I think the Soarstar is a good one to learn with. —*Rebecca Yarrish*

The author's 10-year-old daughter, Rebecca, is busy sanding the foam fuselage halves before she epoxies them together. The Soarstar is very easy to assemble.

SOARSTAR

have held up surprisingly well. Two grooves are molded in the sides of the fuselage pod, and the outer pushrod sleeves are epoxied into them. Use some tape to hold the sleeves in place along the boom stick as shown in the instructions; then you're ready to install the solid rudder and elevator pushrod wires.

POWER SYSTEM

The ESC included in the kit has a 5V battery eliminator circuit (BEC), and the entire power system comes wired and ready to be installed. The ESC can be used with from 6 to 10 cells and is rated at 16 amps with a thermal-overload auto motor cutoff. An 8-cell, 600mAh AA pack that weighs 6.3 ounces comes with the Soarstar; we also used a homemade 8-cell 600mAh AE battery pack that weighs 5.6 ounces.

The RS380 motor has a 1.85:1 gearbox that turns an 8-inch pusher prop. At full throttle, the system draws about 10 amps of current; this equates to about 80 watts of power and about 5-minute flights. Of course, you can extend this time by throttling back and drawing fewer amps. Hook-and-loop fastener is included to secure the receiver, ESC and battery pack inside the fuselage pod.

FINAL ASSEMBLY

Install the wheels, attach the prop to the motor and then, using the included rubber bands, attach the motor to the motor-mount rails and dowel. Cut two holes in the vacuum-formed motor cover, and slip it into place while capturing the ends of the motor-attachment dowel in the two holes. Install the tailskid wire and attach the plastic cockpit cover (optional), and the model is complete. Although the instruction manual does not tell you where to position the CG, I calculated it to be between 3.5 and 3.75 inches from the leading edge of the wing.

OUR RECOMMENDATION

The Soarstar is a welcome addition to the ever-increasing field of easy-to-build-and-fly park flyers. It's stable enough to use as a trainer, and because it's made mostly out of foam, it doesn't weigh enough to be damaged if it hits the ground at more than landing speed. My daughter and I really enjoyed building the model and have had many happy flights with it. If you want to relax and enjoy no-pressure flying, or if you have your own willing pupil, consider the Soarstar; it has a lot going for it.

***Hitec RCD Inc.**, 12115 Paine St., Poway, CA 92064; (858) 748-6948; fax (858) 748-1767; www.hitecrcd.com.*
***Horizon Hobby Inc.**, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511; www.horizonhobby.com.*

CAJ

Above: Jeff Fukushima's Grumman F-9 Panther, built from a new Vortech Models kit with molded fiberglass fuselage and balsa-sheeted foam-core wings (photo by Joe Chovan). Left: main flying site at the Southern California PSS Festival. Note the three Mustangs in formation (built from Durable Aircraft Models kits) and a pair of Mitsubishi Zeros built from Vortech Models kits. Right: Tony Matyi's slope scale Messerschmitt Me-109, immaculately finished by ace builder and painter Jack George.

Power scale soaring (PSS) combines the majesty of silent flight and the speed and aerobatics of slope soaring with the realism and great looks of scale modeling. PSS sailplanes are modeled after full-scale, powered aircraft and, depending on the skill of the designer and the craftsmanship of the builder, the planes range from pleasing approximations of jets, warbirds and civil aircraft to beautifully detailed renditions that rival museum-quality models.

by Dave Garwood

Scale slope soaring at its best!

Below: Tom Ramirez launches Max Parubrub's EPP-foam Lockheed T-33, an original design by Wade Kloos.

At PSS events, flying is plentiful and being judged is optional. Those who enter the contest portions of the events have their models judged by a committee on how well they resemble a specific real jet or a propeller-powered plane in outline, markings and finish. To earn a trophy, a model must attempt at least one flight.

To experience the high end of PSS, the place to be is the Southern California PSS Festival, where the top builders and designers of slope jets, warbirds and interesting civilian aircraft models come to strut their stuff. There is a year-to-year, friendly, but fierce, competition between the East Coast and the West Coast pilots to show off their finely detailed models and fly them in the "big air" of the California mountains.

ON SUMMIT

PHOTOS BY DAVE GARWOOD

Southern California PSS Festival 2001 Awards

PILOTS' CHOICE

Carl Maas, P-51 "Voodoo"

BEST JET

1. **Dave Sanders,** Republic F-105 Thunderchief
2. **Jeff Fukushima,** Grumman F9F Panther
3. **Brian Laird,** Grumman F9F Panther

BEST FOAM MODEL

1. **Pat Bowman and Doug Turner,** Aero Commander
2. **John Cummings,** McDonnell-Douglas F-18 Hornet
3. **Lee Watson,** Rockwell OV-10 Bronco

BEST PROP-DRIVEN AIRCRAFT

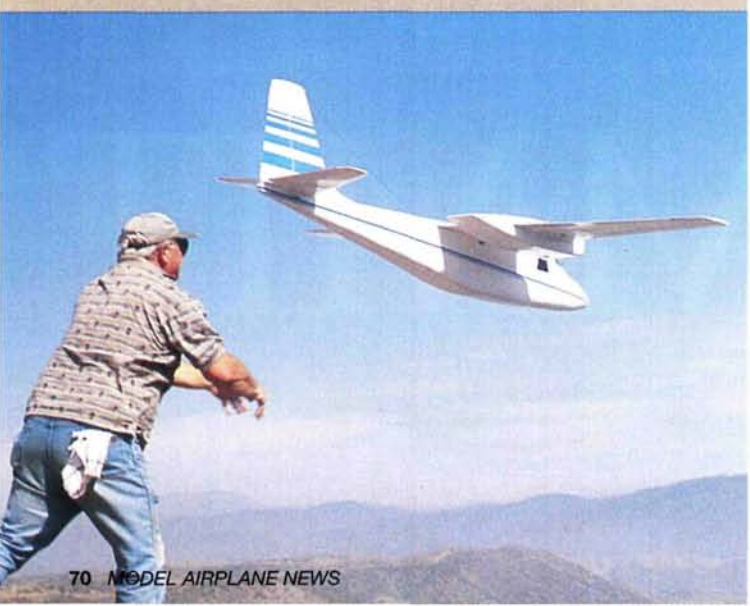
1. **Carl Maas Sr.,** Schoenfeld "Firecracker"
2. **Jeff Vosberg,** Yak-11 "Mr. Awesome"
3. **Carl Maas,** Focke-Wulf TA-152

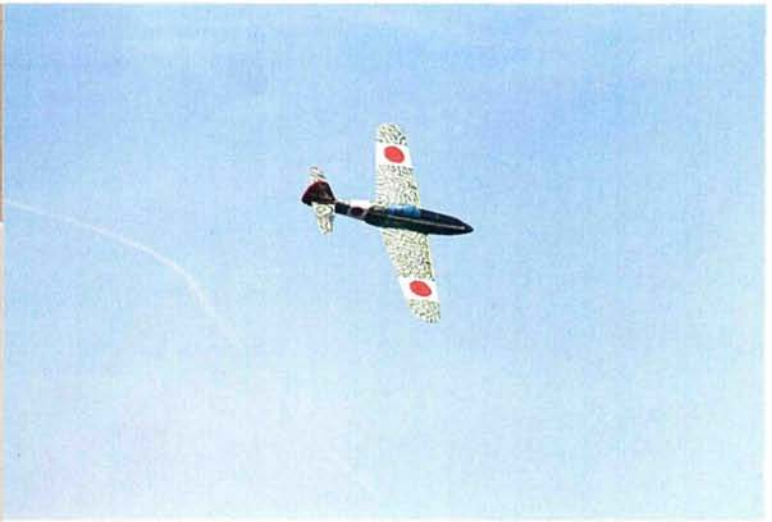
BEST WW II AIRCRAFT

1. **Brian Laird,** Messerschmitt Me-262
2. **Dave Sanders,** Kawasaki Ki-61
3. **Brian Koester,** Curtiss P-40

BEST CIVILIAN AIRCRAFT

1. **Carl Maas,** P-51 "Voodoo"
2. **Kevin Carlson,** Seafury "Miss Merced"
3. **Wes Pearson,** Laser 200





This was the fourth running of the PSS festival at Cajon Summit, and the Inland Slope Rebels (ISR) again did a first-rate job of staging the meet; their Cajon Summit flying site anchors the event. A mile-long ridge 1,400 feet above the valley floor has 15 to 20mph winds on most days, as the high desert to the east heats up and then pulls the cooler air from the Pacific coast, which is 40 miles to the west. The ISR club provided food and shelter for fliers and observers and ran another great meet.

THE PLANES

The PSS Festival stimulates the production of new and innovative designs; there are always many models made of traditional fiberglass and foam construction and also some exceedingly impressive work in EPP foam. I failed the quiz on Ralph Roberts' Republic P-47 Thunderbolt construction material; yep, it's made of EPP, but it is hard to tell that it isn't fiberglass. Pat Bowman and Doug Turner's big EPP Rockwell Aero Commander is a great example of how far you can go with this innovative building material, and Durable Aircraft Models 1/7 scale EPP P-51 Mustangs are a common sight in the air over Cajon, sometimes flying in groups of three.

Longtime EPP advocate Dave Sanders showed a molded-fiberglass Kawasaki Ki-61 he plans to kit soon, and we saw Jeff Fukushima's new, molded Grumman F-9 Panther for the first time. Watching Brian Laird and Jeff Fukushima fly a pair of Panthers at the same time was a treat. Brian also flew his new, molded Messerschmitt Me-262, and, man, that presented a distinctive shape in the air.

Other memorable planes include Dave Sanders' F-105 Thunderchief in Vietnam paint, Carl Maas Sr.'s bright yellow Schoenfeld Firecracker racer, Mike Truhe's and Josh Numan's Vortech Zeros and Brian Koester's Sukhoi Su-35 fighter. Few builders detail a warbird paint scheme as Jack George does; he brought several of his slope scale planes, including an impressive pair of Grumman F6F Hellcats in squadron colors.

Dave Wenzlick got his small white-foam F-16 Fighting Falcon sorted out after some months of effort when he installed a new wing on an E-Jets kit. That little plane now moves like a rocket.

Warmup for the Festival starts on a Friday, and this year, we were fortunate to have had outstanding lift on a warm, sunny day.

Above: Dave Sanders' molded fiberglass Kawasaki Ki-61 has balsa-sheeted foam-core wings; it's a new kit from Dave's Aircraft Works. Left: Pat Bowman launches his EPP-foam Rockwell Aero Commander while Doug Turner is at the controls.

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Dave's Aircraft Works	Patton Aircraft	SR Hobbies
	Quiet Flight Intl.	Trick R/C
	Reese Productions	Vortech Models

Above: Brian Laird and Jeff Fukushima fly Grumman F-9 Panthers in formation (both built from the new Vortech Models kit). Right: Pat Bowman and Doug Turner built this large-scale Rockwell Aero Commander entirely of EPP foam.

Pilots tended to fly their backup planes and saved their primo stuff for the Saturday judging. Plenty of pilots were available for full-contact combat furballs with foamie warbirds on the main hill, and the fast hill hosted a slope scale party of eight or more fast, fiberglass planes flying synchronized, stall-turn "half-pipe" maneuvers. I didn't see any spectacular midair collisions this year, but a few planes finished their flights in manzanita bushes. It's easy to lose track of where the ground is during this kind of action!

Pat Bowman and others flew the back side of the hill in the notch between the two other flying sites, thus demonstrating that fearsome speeds can be achieved with dynamic soaring.

THE COMPETITION

Saturday dawned clear, and by noon, 50 pilots and more than 100 sailplanes were at the hill. The wind was lighter than it had been on Friday, but it gradually increased as the day wore on; new designs were launched in the late afternoon. The scale judging took place in mid-afternoon and was followed by the trophy presentations and a mega-raffle. Dozens of pilots flew for three hours more before calling it a day.

Sunday was scheduled to be a relaxed day—no formal activities. The wind blew at 30mph, but unfortunately, Cajon Summit was shrouded in fog all day. This didn't stop the foamie pilots—at least those with good thumbs and trimmed airplanes—from turning and burning in close, but the fog grounded the more exotic ships. We would like to have flown for a third day, but most agreed that two days of excellent lift, "extreme" piloting and a chance to see the cutting edge of power scale soaring design made the trip worthwhile.

For more photos of this event and previous PSS Festivals, as well as information about next year's event, visit the ISR website at http://ourworld.compuserve.com/homepages/ISR. Also listed on the website are other Southern California slope-soaring sites, in case you have a chance to spend a few days in the area before or after the event.

A Speed 400 rendition of the fearsome Stormbird

MINI Me 262 A-2a

by Mark Rittinger

The Stormbird. It was a name that struck fear in the hearts of Allied pilots in World War II. In 1939, the RLM (Reichsluftfahrtministerium), or Air Transport Ministry, asked Messerschmitt AG to design a new fighter that would be flown with jet-turbine engines, which were as yet unproven. Ultimately powered by two temperamental Junkers Jumo 004 turbojet engines, the Me 262A-1a "Swallow" went into production. One hundred were ordered, but an Allied raid on Bavaria delayed delivery of these first units by many months. Hitler's insistence that this wonder weapon be used as a bomber rather than as a fighter further hampered the jet's effectiveness. By the time the 262A-2a "Stormbird" bomber variant became available, it was too late to change the course of the airwar in Europe.

Nearly 100mph faster than any Allied fighter, the Me 262 was a formidable weapon. Most Allied kills of 262s occurred during the plane's takeoff and landing. It was dangerous to encounter it anywhere else, as it carried four 30mm cannon in the nose, and some carried R4M rockets under the wings. Made famous by Adolf Galland, the 262 taught many lessons to the Allies after the War, both in jet technology and in aircraft design, particularly in the area of swept wings. I have always liked the distinctive shape of the Me 262 with its swept wing, high tail and triangular fuselage that resembles a shark.

I built a prototype Mini Me 262 in 1999, with two handmade fans and a span of about 44 inches. The fans didn't have the power I was looking for, so I switched to pusher props. These worked well, but they needed 480 motors instead of 400s to fly. So I went back to the drawing board and came up with the design shown here. It has proven to be easy to build, durable, light and fast. It's all you could ask for in a Speed 400 twin ship. Anyone who can handle a fast-moving, low-wing model can fly it. It grooves well, and landing speeds aren't that high. So, if you fancy yourself a jet jock and you want a model that stands out from the crowd, gather some balsa, and let's get started.

THE FUSELAGE

There are some new techniques here that you might not have encountered before. Not many planes have a cross-section like the Stormbird's. Start by cutting the fuselage bottom to shape from 1/16-inch medium balsa. Do not cut out the center piece on the bottom of the fuse where the wing is attached. Laminate all bulkheads from two cross-grained layers of 1/16-inch balsa. I found

SPECIFICATIONS

Model: Mini Me 262A-2a

Type: twin-prop-driven jet

Wingspan: 38 in.

Wing area: 209 sq. in.

Weight: 30 oz.

Wing loading: 20.7 oz./sq. ft.

Motor used: two Speed 400s with APC 5x5 props

Radio used: 3-channel (throttle, aileron, elevator)

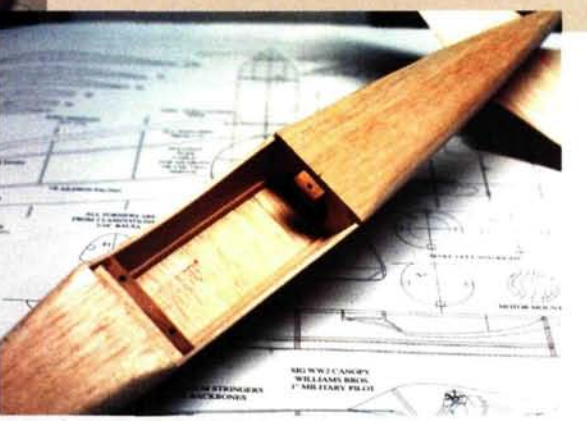
Comments: designed by Mark Rittinger, the Mini Me 262 is a semi-scale, low-wing, twin electric that is quick to build and great fun in the air. The balsa and ply model flies well, thanks to a low wing loading, a flat-bottom wing and plenty of power, and it really excels at high-speed maneuvers.

it most convenient to laminate a 3-inch-wide piece and then cut out the parts with a jeweler's saw. Prop up the front and rear of the bottom fuse, and add the triangle stock, bulkheads and stringers. The battery tray also fits in now. This stiffens up the structure.

Sand the tri-stock to the correct curve to match the sides, and begin sheeting the fuselage from the rear. First, glue the 1/16-inch sheet to the tri-stock, bend it over to the top stringer, then mark, cut and glue it into place. This works for all the rear and lower sheeting. *Do not* glue together past F5; the fin fits in here. When all the sheeting has been done, remove the fuse from the building board and cut out the wing-saddle section. Add the small doublers, and cut the saddle to shape. The nose block and wing hold-down blocks go in next; then, all that's left is to cut out the cockpit and the fresh-air holes in the nose that double as cannon muzzles. Cut a small hatch in the bottom sheeting through which you will install the elevator servo; it will be covered later.

This is the first step in framing up the fuselage. Prop up both ends of the bottom sheeting, but make sure the bulkheads remain perpendicular to the plan.

Here is the fuselage structure basically complete with the battery tray in place. Start sheeting at the tail section. Note that the sheeting where the wing will be joined should not be removed at this time.



When the fuse is complete, you can cut out the sheeting over the wing hold-down bolt locations.

FLIGHT PERFORMANCE

Make sure your control throws are close to the recommended amounts. Be absolutely positive that left is left and up is up and that there is no binding or stalling of servos. Install a charged 8-cell pack, and check the CG one last time.

• TAKEOFF AND LANDING

Start with a few clicks of up-trim. Point your plane into the wind, and give a firm toss with wings level, nose slightly raised and at full power. It shouldn't need too much in the way of trim. Mine flew right out of my hand at a nice climb of 30 degrees, and I added a bit of down-trim. It ended up being right in the center of the gimbal, anyway! It was so smooth that it was almost anticlimactic.

The model has plenty of climbing power to get to altitude. Landings require a bit of thought, and you are wise to practice before it actually must come down. This is not really due to any bad characteristics, but the plane is small, and you will need to gauge the sink rate. Line it up into the wind and grease it in. Always leave enough power in the pack to make a go-around, in case you need one. If you tend to lose planes south of the treeline, add some non-scale bright colors; I almost lost mine in the trees! (Thank you, yellow squadron band!)

• LOW- AND HIGH-SPEED PERFORMANCE

The Me 262 was designed for good high-speed performance. At top speed, it's very stable—a result, no doubt, of its dihedral, wing sweep and ample fin area. It has a good "groove" and actually reminds me of a small twin pattern ship. Slow speeds are not Cub-like, but it handles well. A loss of aileron control followed by a severe dipping of the nose warns you of a stall. These stalls, however, are at a very slow speed because of the amount of washout.

• AEROBATICS

It will do any aerobatics that demand aileron and elevator. Rolls are surprisingly nice, and large loops can be done from level flight. It will do nice Cuban-8's, Immelmanns and Split-S's. But what really makes this little bugger amaze people is a dive from about 200 feet into a high-speed pass, followed by a victory roll. I flew a demo flight at the Romeo, MI, club model airshow, and many were amazed at the top-end speed with two $8 motors! Needless to say, it scoots!

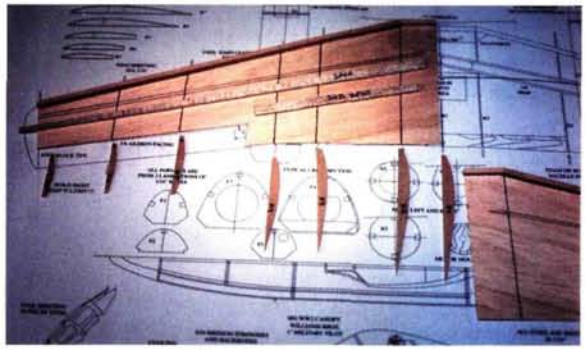
This is the basic fin and stabilizer assembly. Note the triangle stock in place to reinforce the joints.

TAIL ASSEMBLY

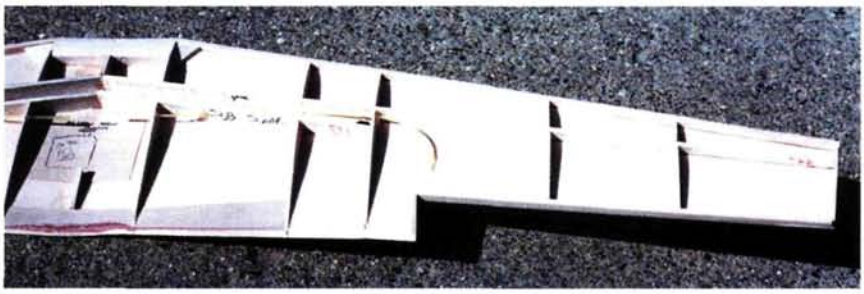
Cut the fin from ⅛-inch medium balsa, and carefully mark the stabilizer cutout. It must have +1 degree of incidence. This may seem minor, but it is important to the handling. The fin extends from F5 to the rear and all the way to the bottom of the fuse. Cut the stab from 3/32-inch balsa, and glue it in using a square to make it true. The tri-stock under it will add some strength. After building the assembly, pin down the fuse to the flat building board, and glue the tail into place. Make sure it lines up true in all directions.

THE WING

Cut out all ribs, spars and plywood pieces first. Make the lower wing skins from 1/16-inch sheeting, and cut them to the exact outlines. Add the leading edge (LE), spars and aileron facings. Prop up the tips 1½ inches on each side, and glue the two lower wing skins together with the correct dihedral. Lay in the ½-inch-wide glass tape with CA, and carefully fit the block in the front section where the bolts go through. Put the 1/64-inch ply piece in the trailing edge

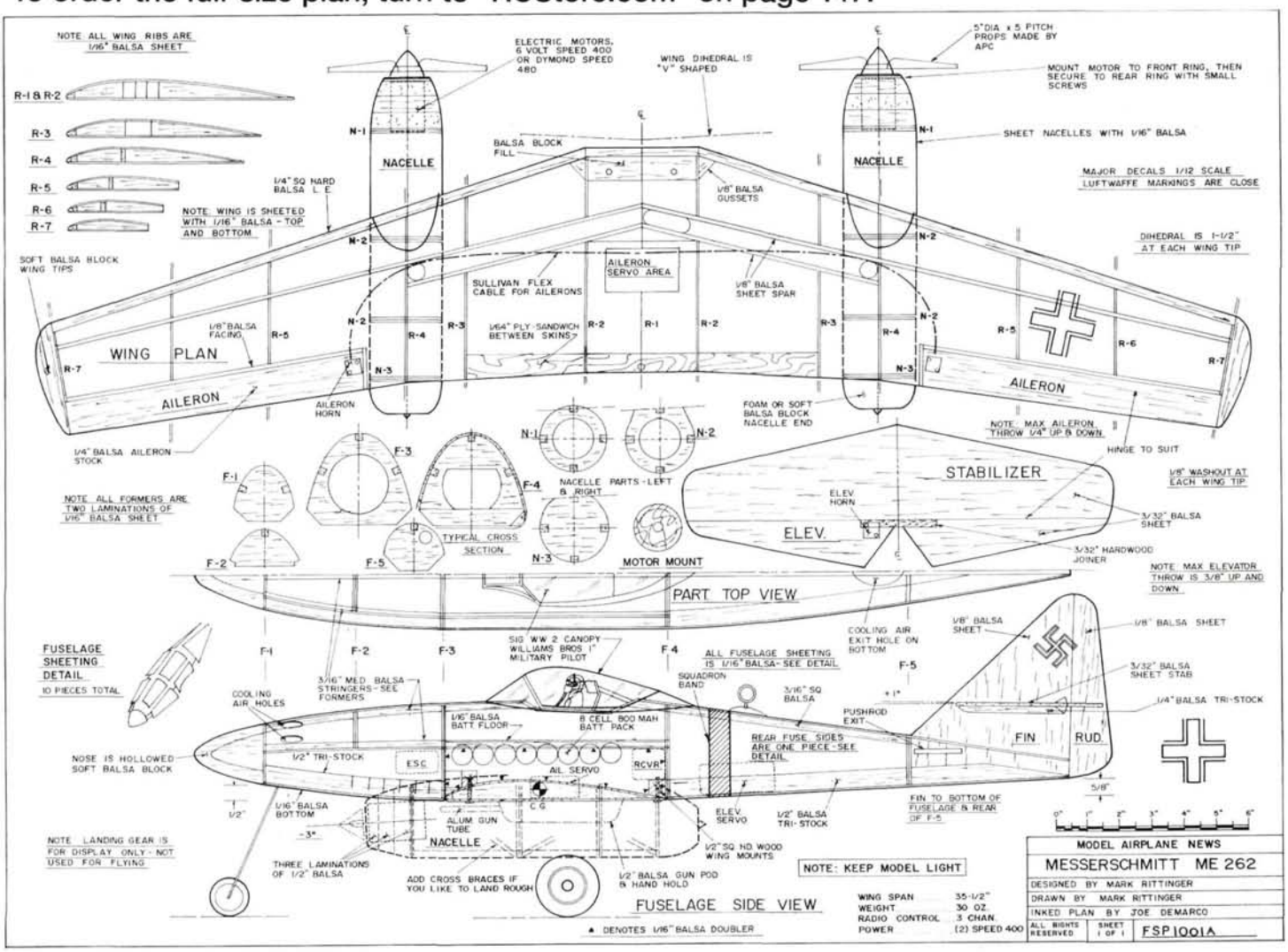


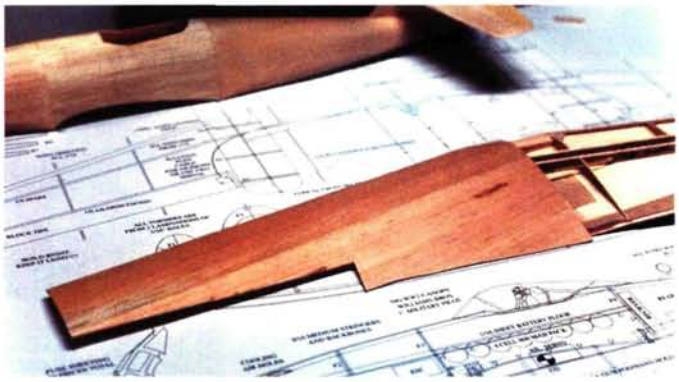
The wing assembly is very simple and uses a minimal number of pieces.



The wing structure incorporates a 1/64-inch-ply servo mount, tubing for the aileron-control cables and a tapered trailing edge and gussets.

To order the full-size plan, turn to "RCStore.com" on page 147.





Use an 1/8-inch guide to set the correct amount of washout, and then glue on the wing's top skin. Cut the other wing skin to match the root of the first, and glue it on.

(TE) and add the gussets shown. You will have to put some small holes through the ribs and spars to fit the Sullivan cable through for the ailerons. Make sure you put them high enough in the center to ensure that the servo output arm will not bind after you've connected the cables. Use the tiny cable—not the heavy one. At this point, use a bar-type sander to radius the LE, and lightly go over the ribs and spars to ensure there is sufficient contact.

Make a washout guide from 1/8-inch-square stock, 1/8 inch high at the tip and tapering down to zero at the root. Pin the wing down with the guide on the board under the aileron faces, and glue on the top skin. I typically use medium CA for this, but some may prefer slower glue. After the glue has set, cut the other skin to match the root of the sheeting you've already installed. You'll need to sand the sheeting's edge slightly concave. Follow the same procedure on this side, and apply some nylon or glass tape to the center top.

Trim the excess wood from the skins, and sand the LE to shape, along with the tips and the ailerons themselves. Cut out your aileron servo hole so you'll eventually be able to fish the motor wires through.

THE NACELLES

These aren't as hard to do as they may seem, but to build them straight, you do need to pay attention to detail. Once again, assemble bulkheads from laminated 1/16-inch sheet. Don't try to cut corners by using one piece of 1/8 inch—it has strength in only one direction, and you'll need it in both directions. Note that there is an angle on the top for the dihedral.

Assemble the four basic balsa formers and four stringers. You will need to remove half of the top one for it to fit flush with the bottom of the wing. From the LE forward, it is still 3/16-inch-square stock.

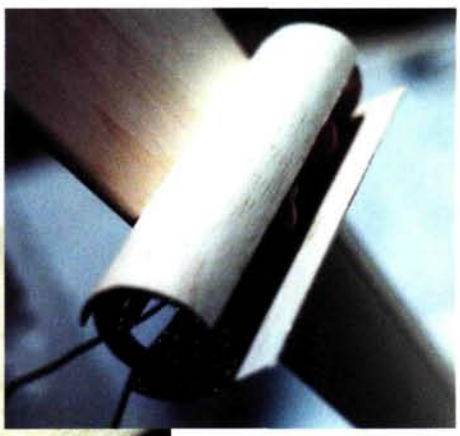
Stand the wing on its TE, and, using a triangle, mark the centerline of the nacelles on the bottom of the wing. Now, make a line 3/32 inch to either side of it, and you have the location of the center stringer on the wing—both perfectly parallel. Glue your nacelle frames to the wing, and fish the motor wires through the wing and nacelles. Sheet the frames with 1/16-inch balsa, and add the tail and nose blocks. Hollow these out as much as possible to save precious grams. The motors are mounted on round, 1/16-inch-ply bulkheads with 2.5mm Allen-head screws, which in turn are mounted on the 1/16-inch-ply rings on the nacelles with sheet-metal screws. With this step done, the Me 262 really starts to look like a jet fighter.

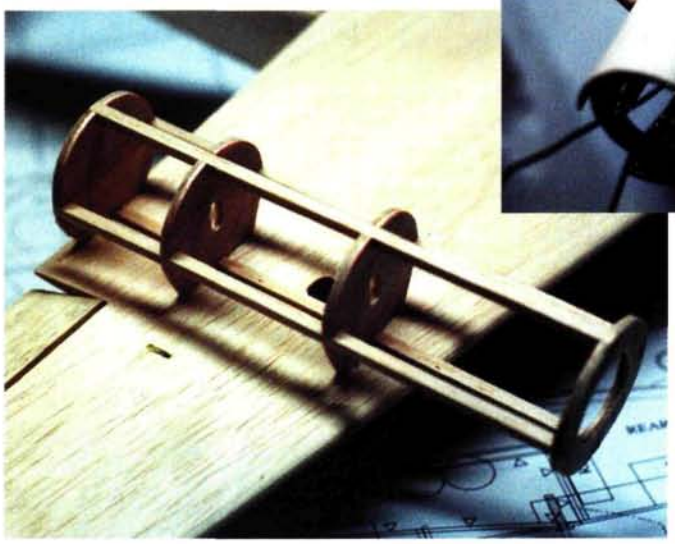
Three laminated, hollowed, 1/2-inch-balsa rings create the nacelle's front contour. The motor is mounted on a 1/16-inch-ply bulkhead with three Allen-head screws.

FINAL ASSEMBLY

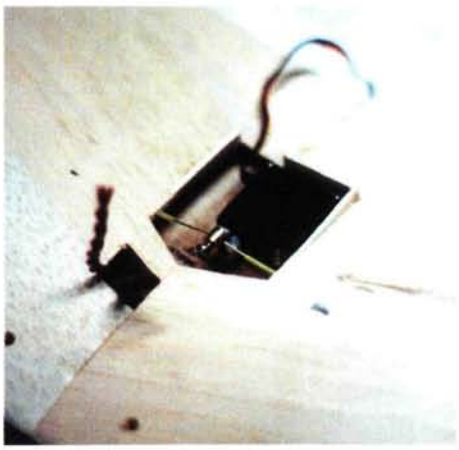
By now you have probably set up the pieces on your bench, "just to see how it looks." Pretty good, huh?

Next, set the wing-to-tail incidence; it isn't that hard, if you've built true to the plan. Set the wing assembly on a flat surface. The nacelles are straight across the bottom, so as long as they are flat, the wing is flat also. Set the fuselage in the wing saddle, and check for +1 degree in the stabilizer. If it isn't where it ought to be, sand the wing saddle until you achieve correct alignment; this is critical. Without it, the plane will climb as speed increases. At this point, also check for correct downthrust, but no right thrust is necessary. Make sure that the fin is straight and the stabilizer is not tilted.





The nacelle structure is straightforward, but you must be careful to build them straight. Notice the placement of the laminated bulkheads and the holes in the wing sheeting for motor wiring and the aileron cable. Each nacelle can be sheeted in two halves using 1/16-inch balsa.



With the aileron servo installed, you can see the control-cable arrangement and linkage.

The fully assembled Mini Me 262 is ready for MonoKote and some Rustoleum spray paint.

RADIO INSTALLATION

Radio installation is straightforward. The switch goes in first, in the nose on the bottom. Put in the elevator servo using two-sided tape to attach it to the fuse bottom. Also install the aileron servo with tape, and feed the small cable through the outer Nyrod, through the joiner and out the other side. Try to set the joiner in the first hole of the output arm. It doesn't need a lot of aileron throw to fly well. The ESC sits up front, the receiver fits under the rear wing hold-down block (a Hitec 555 does, anyway!). Then put the battery pack in. Now is the time to check the CG and shift the battery around until it's correct. Balance it at the tips, right side up. Swept wings are sensitive to rearward CG, so get it right where the plan says.

COVERING

I am often asked what I used on my Me 262. I wanted it to be light and accurate, so I covered the entire plane in Flat Gray MonoKote and then scuffed the top surfaces with a machinist's "scrubbie" to provide some bite for the paint. Since it's electric, there's no need to dip into your pockets for "fuelproof" anything, so I went with Rustoleum OD Green and Flat Earth spray paints. These are perfect for military electric models. The colors look great, stick well and don't add much weight. I estimate it added 1 ounce. The right colors add reality to a scale model! The markings are Major Decals, WW II German 1/12 scale, except those on the fuselage, which were cut from white trim dulled with steel wool.

MOTOR SETUP

The two Speed 400 6V motors are wired in parallel from the ESC, and I used Deans polarized connectors between the wing and the ESC and the battery and the ESC. I wired them so that I can't accidentally connect the battery to the wing. Make sure both motors turn in the correct direction. I would hate to see the spin you'd have if one spun the wrong way. I used Graupner High Speed spinners, as they look a bit like the starter housings on the real ship. I use a 20A fuse on my twins, and things work fine at that amperage.

CONCLUSION

I hope you have as much fun as I do with the Mini Me 262! I'll wait to see how long it takes for some industrious person to drop in two brushless 020s! A special thanks to Charlie Rittinger, Jack Rosenthal, John Fotiu and Prop Shop Hobbies for all their help.

Anyone who has questions or who's in need of assistance, feel free to contact me via email at mrittinger70@hotmail.com. I will be happy to help a fellow modeler!

APC Props; *distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

Deans, *10875 Portal Dr., Los Alamitos, CA 90720; (714) 828-6494; fax (714) 828-6252; deansco@earthlink.net.*

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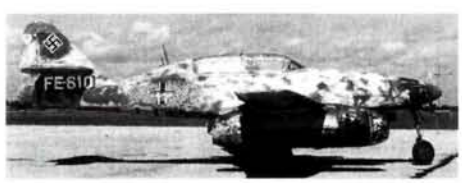


Make a Static-Scale Wooden Prop

An easy technique for improved scores

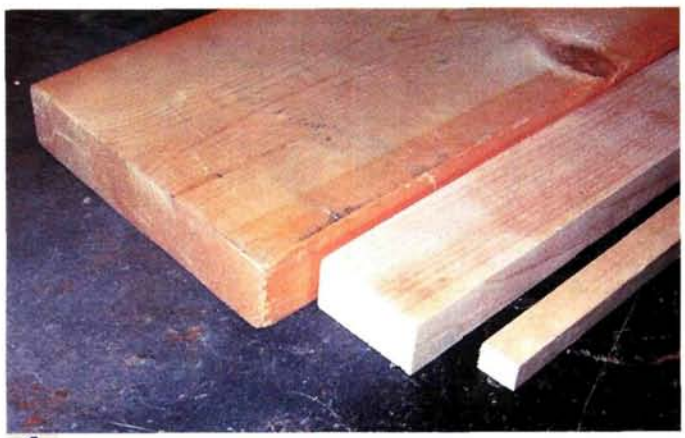
by Gerry Yarrish

Here's the static prop on my L-4. It really adds to the model's overall scale realism.

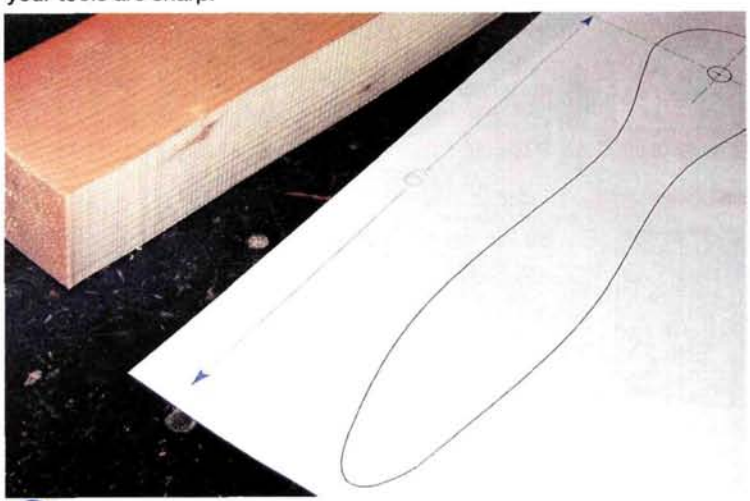
One of the easiest ways to improve your static score is to replace your model's flying prop with a static scale prop before you put your model on the judging table. For my ¼-scale Piper L-4 Grasshopper I needed an 18-inch-diameter Sensenich prop, so I carved my own. Carving a scale prop isn't as difficult as you might imagine; all it takes is a little planning and some cutting, shaping and sanding. Although this article shows how to make a wooden prop with a shiny polyurethane finish, you can use the same technique to make scale metal-finish props simply by painting and polishing the prop to suit your needs. Let's get started.

Note: use only commercially available, hardwood or plastic props to fly with. Static-display propellers should never be used with a running engine.

You'll only need a few tools: a heavy-duty utility knife with several spare blades; a couple of inexpensive long razor knives; a two-handed drawknife or "spoke shaver"; and a small carpenter's plane. A jigsaw or a band saw is also helpful but not necessary, as you can also use a hand-held coping saw to cut out the prop. For best results, make sure your tools are sharp.



1 I like to use 5/4 (1¼-inch-thick) no. 2 pine for making props. It is easy to cut and shape, is relatively inexpensive and readily available at lumberyards and home improvement stores. Here, you can see how much thicker the 5/4 pine is than the standard ¾-inch pine stock. You can glue two ¾-inch pine boards together to make a thicker piece, but the seam in the prop would be visible under the clear finish.

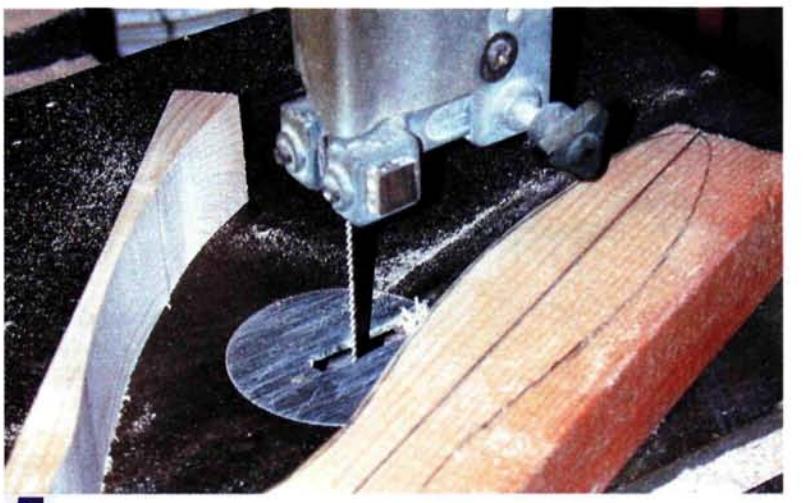


PHOTOS BY GERRY YARRISH

2 Use your scale 3-view drawings to make a prop template. I use a half template so that both halves of the prop are symmetrical. Roughly cut your wooden prop blank to size, making it about an inch larger all around than the finished size will be.

3 Draw a centerline on the wood blank, and then drill a hole in the middle of it with a bit that's the same size as your prop shaft. Make sure to drill the hole square to the wood face.

Cut out your template; using the drill bit as an index pin, align the prop template centerline with the line drawn on the wood blank and trace half of the prop. Rotate the template 180 degrees, and then draw the second half of the prop.

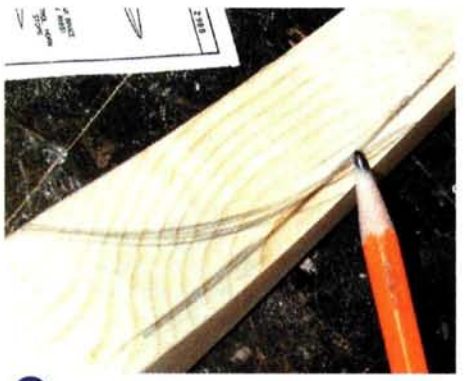


5 Here, I am using a band saw to make the first cut. Leave a little extra wood around the outline so that you will be able to sand the sides to the line.

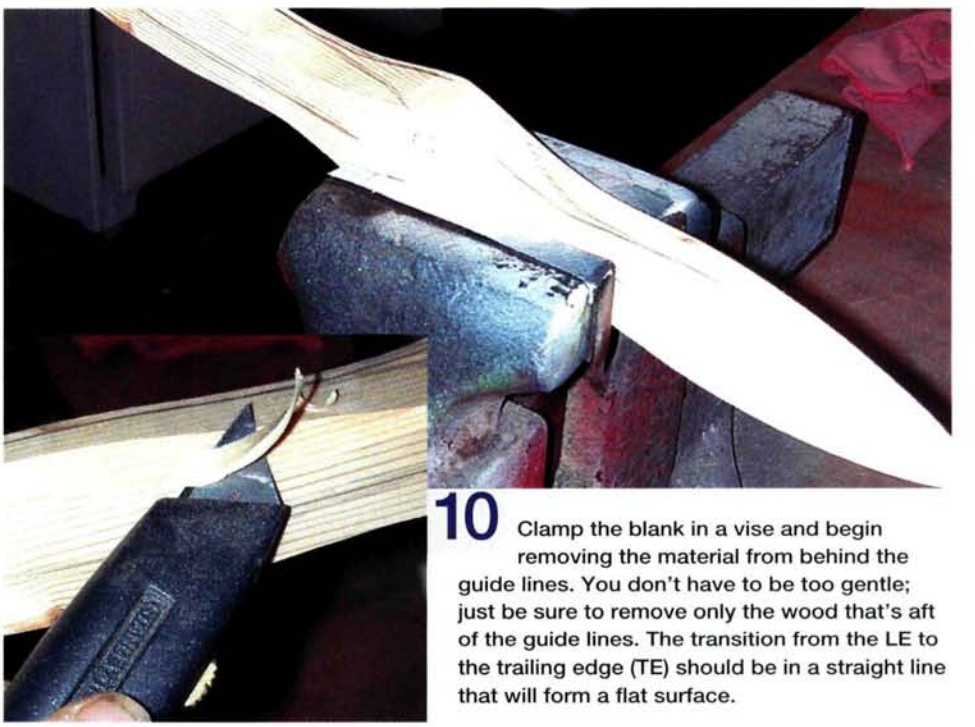
6 To speed up the process, I use a belt sander to remove the saw marks and to sand to the line. You could also do this by hand using flat and round sanding blocks.

7 Turn the blank on its side and use a side-view template to draw the outline of the prop's side shape.

8 With the blank still on its side, saw through its front and rear sides as shown. Remember to leave a small margin of wood around the outline. Then sand to remove the saw marks.



9 About ¼ inch from the face, use a pencil to mark along the leading edge (LE) and then draw a curved line to define the prop's hub area. The area behind these lines will be cut away to form the underside shape of the prop's airfoil.



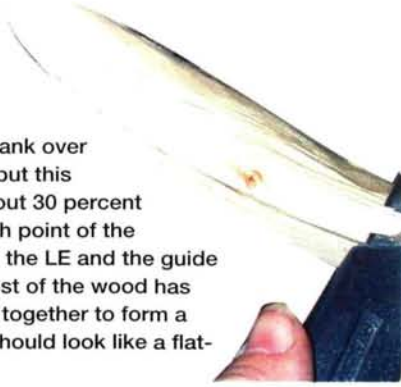
10 Clamp the blank in a vise and begin removing the material from behind the guide lines. You don't have to be too gentle; just be sure to remove only the wood that's aft of the guide lines. The transition from the LE to the trailing edge (TE) should be in a straight line that will form a flat surface.

PROP DECALS

The items that really make a static scale prop come alive are properly placed propeller-manufacturer decals. The decals I used are from Major Decals and are available in stick-on and water-slide style. If you decide to use them, apply them before you clearcoat your prop.

14 Here's what you'll need to ensure a smooth, clear finish: a 1-inch-wide brush; fine-grit sandpaper (220 and 320 grit); a Scotch-brand finishing pad; a premium-grade sanding sealer (Cabot Stains); a fast-drying clear satin or glossy polyurethane (Minwax); and Krylon Crystal-Clear acrylic spray paint.

15 Wipe the prop clean of all dust and cover your workbench with newspaper. Brush on an even coat of sanding sealer and let it dry. Sand the surface smooth with 220-grit sandpaper, wipe clean and apply a second coat of sealer. When it's dry, sand the prop again with 320 grit. Wipe the prop dust off again and brush on two coats of clear polyurethane, sanding with 320-grit sandpaper between the coats.



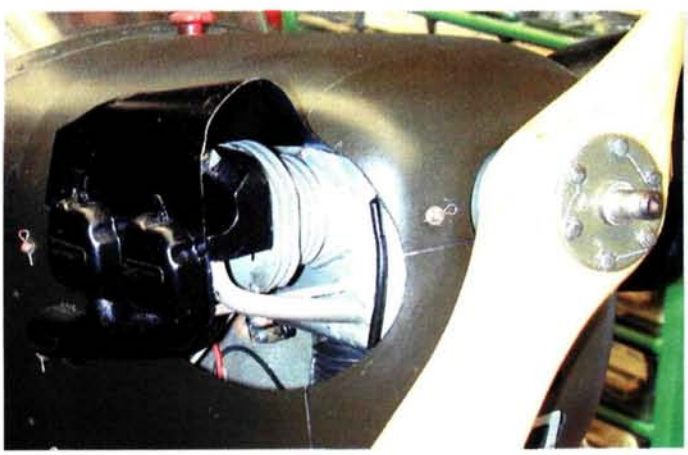
11 To form the prop's front surface, turn the blank over in the vise and repeat what you did earlier, but this time, draw a guide line on the prop face about 30 percent of the blade's width back from the LE. This is the high point of the curved front face; remove the material from between the LE and the guide line, and then from the TE to the guide line. Once most of the wood has been carved away, blend the front and rear surfaces together to form a convex curve shape. The prop blade cross-section should look like a flat-bottom airfoil.

12 Using short, quick strokes, smooth the prop face with a plane. Set the plane's blade in a shallow position so it doesn't gouge the wood.

13 Finish the prop by sanding it smooth with a power sander, as shown here, or by hand with progressively finer sandpaper; in either case, start with 100 grit and then follow with 220 and, finally, 320 grit.

16 To complete the project, you can add decals and painted on details such as the brass leading-edge strip shown here. Use a metallic paint for this and buff it when it has dried. After you've added all the details, spray on a couple of protective coats of the Krylon Crystal-Clear acrylic paint.

17 With some models, the engine's thrust washer may be too far forward and that places your new scale prop too far away from the front of the engine cowl. If you counter-bore the back of the prop as shown, you'll be able to slide the prop into its scale position with little effort.



18 Make the engine hub detail with sheet plastic or aluminum and a few small 4-40 or 2-56 screws and nuts. The loops of safety wire add much to the hub's finished appearance. ✦

***Major Decals**; distributed by Northeast Screen Graphics, 21 Fisher Ave., P.O. Box 304, East Longmeadow, MA 01028; (413) 525-7465; fax (413) 525-7794; sales@majordecals.com.*

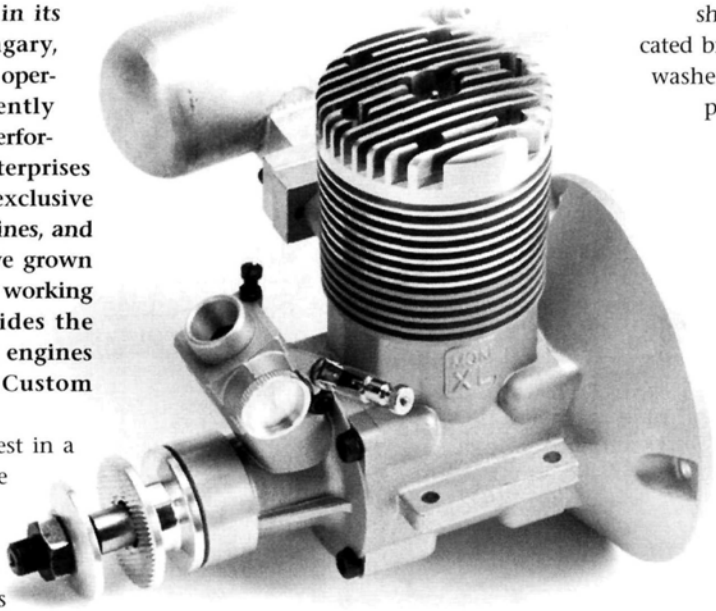
by Dave Gierke

Moki 2.10

Since 1957, Moki has produced 2-stroke model engines in its plant in Budapest, Hungary, and this relatively small operation has maintained consistently high standards for quality and performance. Since 1989, Gerard Enterprises Inc. (Moki USA) has been the exclusive agent and importer of Moki engines, and Moki's sales and reputation have grown steadily. Today, Horizon Hobby, working in concert with Gerard, provides the principal distribution of Moki engines and their companion Bisson Custom Mufflers.

The 2.10 is the latest and largest in a series of Moki high-performance model aircraft engines. Its key dimensions (see "Specifications") are the same as the extremely popular Moki 1.80's, and this means that the new 2.10 can easily replace the smaller 1.80 in most aircraft. The same Bisson mufflers that work with the 1.80 will also fit the 2.10. Available accessories include a remote needle-valve assembly, spinner adapter nuts and a radial backplate mount.

Weighing almost 3 pounds, the glow-fuel-burning 2.10 proved to be a great performer, generating more torque and horsepower than any engine I've previously tested. Moki's design, material selection, fabrication, assembly clearances and special fitting techniques are textbook examples of the engine-makers' art.



Assembled Moki 2.10 with optional radial backplate mount and Sport-Type Bisson custom muffler with adapter plate.

ENGINE CONSTRUCTION

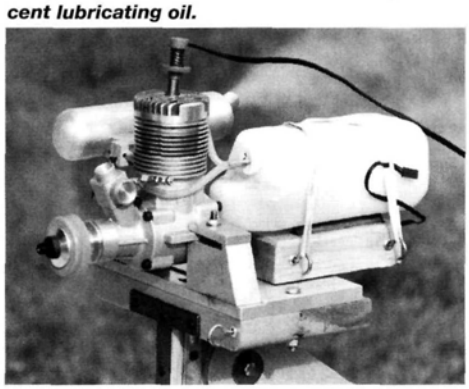
• **Crankcase.** Investment-cast-aluminum alloy; bead-blasted exterior with machined bright areas on the cylinder. The bypass casting incorporates twin dual passageways leading to the Schnuerle cylinder ports. The main crankcase uses a bolt-on front crankshaft housing and a rear cover. Weight: 304 grams.

• **Crankshaft housing.** Investment-cast-aluminum alloy with a bead-blasted exterior. Four (5x0.8x16mm) Allen-head machine screws are used to attach the housing to the crankcase. The housing contains two ball bearings: front—12x28x8mm (0.472-inch i.d., 1.104-inch o.d.) and rear—25x42x9mm (0.985-inch i.d., 1.664-inch o.d.). Weight: 185 grams (with ball bearings). No gasket is needed.

• **Crankshaft.** One-piece steel alloy construction; hardened and ground on centers; 10x1mm nose threads; 0.628-inch-diameter (15.95mm) axial induction hole; crankpin diameter—0.393 inch (9.98mm). Weight: 300 grams.

• **Crankshaft and housing bearing fit.** The crankshaft is a slip-fit to the front ball bearing and a light interference-fit with the rear ball bearing. The 0.020-inch-thick (0.508mm) brass washer is placed over the front nose threads of the crankshaft and followed by the split truncated brass cone and the aluminum drive washer. When clamped into place by a propeller, prop washer and crankshaft nut, the unit is locked to the inner race of the front bearing, between itself and the shoulder of the crankshaft; i.e., the front bearing locks the shaft into place while the inner race of the rear bearing floats; this provides support but not location control. The front bearing offers 0.003 inch (0.076mm) of endplay (axial); this represents the amount of clearance between the balls and the bearing races. Weight (shim washer, drive washer, split cone, prop washer and nut): 56.6 grams.

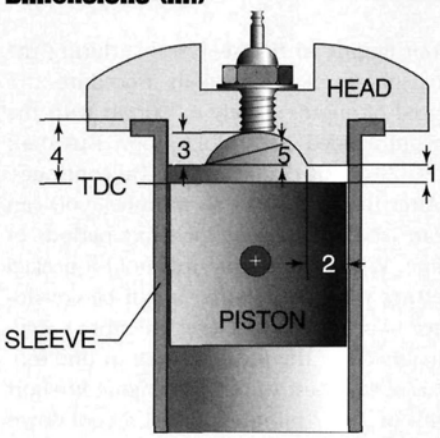
Fitted with a Bisson Sport Muffler, the Moki is shown here operating at wide-open throttle, using 10-percent nitromethane and 20-percent lubricating oil.



• **Cylinder.** Made of alloy steel, the sleeve's bore is initially ground and honed oversize. Next, an electroplating sequence produces a hard chrome surface, which is finish-honed to its final dimension. The 2-inch cylinder is tapered by 0.002 inch (0.051mm); per conventional practice, the top of the cylinder is tighter than the bottom. The porting consists of a large exhaust port divided by a vertical support web. This is the standard technique for preventing destructive piston-ring migration into the port. There are two pairs of Schnuerle transfer ports. The first pair, on either side of the exhaust port, opens slightly before the second pair. The second pair of transfers is outside the first pair. Each of the four transfer ports is angled to a point on the wall of the cylinder opposite the exhaust. The cylinder doesn't have a boost port, which is generally found opposite the exhaust port. The cylinder has a large chamfer at the flange end (cylinder-head end) that assists piston-ring insertion into the cylinder. The cylinder is a sturdy 0.072 inch (1.83mm) thick. The flange is 0.100 inch (2.54mm) thick. Weight: 96 grams.

• **Piston.** Silicon-aluminum alloy with a flat-top crown design (typical of later configurations) working in conjunction with Schnuerle porting. It has a single meehanite (fine-grain cast-iron) compression ring

Head and Combustion Chamber Dimensions (in.)



1	**Head clearance**	0.022 in.
2	**Squish-band width**	0.200 in.
3	**Plug depth**	0.304 in.
4	**Deck clearance**	0.218 in.
5	**Squish-band angle**	8°, 30'

Squish-band area: 48.5 percent
Combustion-chamber area: 51.5 percent

Performance Data and Calculations

Maximum torque (oz.-in.): 560

Maximum corrected bhp: 5.14

Bhp/cid: 2.44

Bhp/pound (bare, without muffler): 1.78

Oz.-in. (torque)/cid: 266

Oz.-in. (torque)/pound (bare, no muffler): 194

Oz.-in. (torque)/$ invested (street price): 1.65

Glow plug (best): K&B 1L

Fuel: 10% nitromethane; 20% lube (10% castor oil, 10% Klotz KL-200); 70% methanol

Break-in propeller: APC 20x8 (2-blade)

Muffler: Bisson Sport w/exhaust adapter

2-blade propellers	Peak rpm
APC 22x10	6,400
APC 20x14	6,600
APC 20x12	7,000 (1,400 reliable idle
Zinger 22x6	7,100
Expert 20x8	7,400
Moki Ultra 20x10	7,600 (26 pounds of static thrust)
APC 20x8w	7,700
APC 18x14	7,700
APC 20x8	8,100 (break-in propeller)
Master Airscrew 18x8	8,500
APC 16x14	8,600 (91 dBa @ 9 feet)
APC 18x10	8,700
APC 18x6	9,400 (2.5 oz./min. fuel consumption)
APC 16x10	9,900

SPECIFICATIONS

Engine: Moki 1.20

Type: 2-stroke

Manufacturer: Moki

Distributor: Gerard Enterprises and Horizon Hobby Inc.

Street price: $339.95

Displacement: 2.105 in.^{3} (34.5cc)

Cylinder bore: 1.417 in. (35.992mm)

Stroke: 1.335 in. (35.909mm)

Bore/stroke: 1.06:1

Stroke/bore: 0.94:1

Connecting rod center-to-center length: 2.346 in. (59.59mm)

Connecting rod/stroke: 1.76:1

Combustion-chamber vol. @ TDC: 0.2112 in.^{3} (3.46cc)

Compression ratio (geometric): 10.97:1

Compression ratio (effective): 8.13:1

Carburetor/choke bore: 0.413 in. (10.5mm)

Weight (bare) w/standard backplate: 46.06 oz. (1,305.7g)

Weight w/radial mount: 51.40 oz. (1,458.2g)

Weight of Bisson Sport-type muffler: 11 oz. (311.85g)

Height (total): 5.82 in. (148mm)

Height from crank centerline: 4.68 in. (119mm)

Width at lugs: 3.25 in. (82.5mm)

Width at crankcase: 2.40 in. (61mm)

Length to prop-drive face: 5.15 in. (131mm)

Length with backplate mount: 6 in. (152mm)

Mounting holes (side to side): 2.75 in. (70mm)

Mounting holes (front to back): 1.49 in. (38mm)

Radial mount diameter: 4.56 in. (116mm)

Radial mount bolt pattern: 3.94 in. (100mm)

Exhaust-bolt spacing: 1.34 in. (34mm)

Crankshaft nose thread: 10x1mm (0.392 in.)

Crankshaft diameter at prop drive (hub): 0.472 in. (12mm)

Ball bearings (F/R): 12x28x8/25x42x9mm

Hits
- Designed as a model airplane engine from the beginning!
- Has a working, fuel-metering carburetor.
- Record-setting horsepower and torque.
- Lots of torque per dollar invested.

Misses
- None found.

Comments: in this year's Top Gun 2001 RC scale competition (see *Model Airplane News*, August 2001), Moki was the engine of choice in the glow-ignition category, with eight aircraft powered by Moki engines. Moki won the Best 2-stroke Performance award for Jeff Foley, who also garnered first place in the prestigious Designer Class.

The Moki 2.10 is a superbly designed and manufactured 2-stroke-cycle model aircraft engine with outstanding performance characteristics per dollar invested. Like the Moki 1.35 and 1.80, this engine sets the standard for all others to follow.

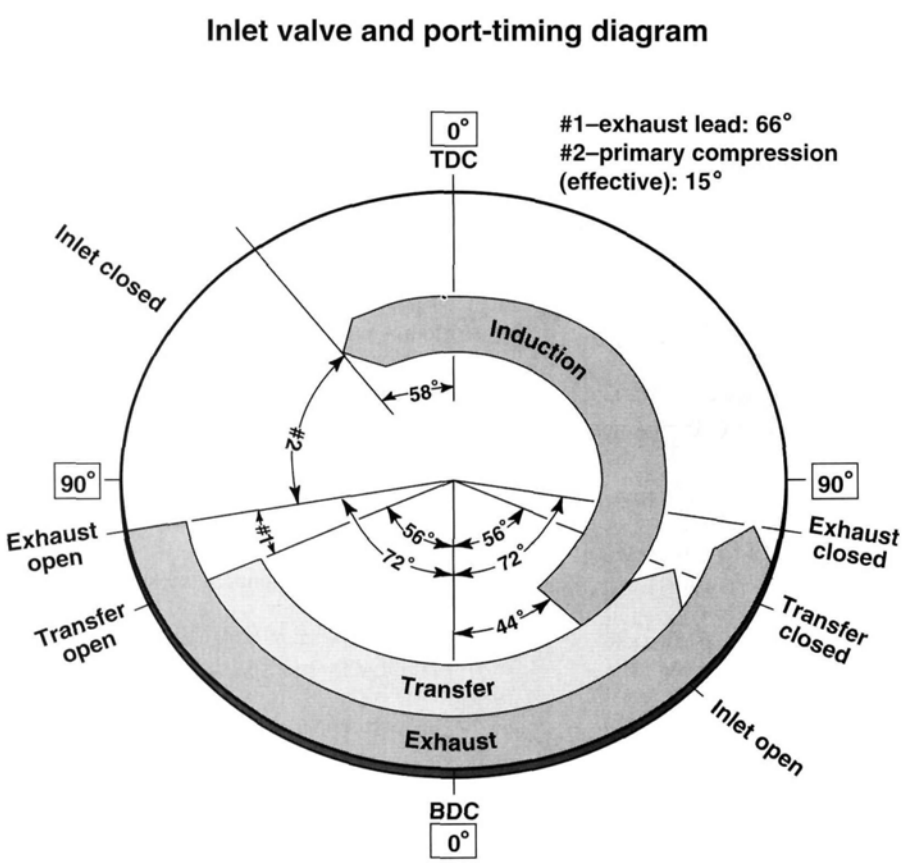
0.055 inch (1.40mm) from the top edge. The ring is pinned radially at a position on the sleeve opposite the exhaust. Two large rectangular cutouts on opposite sides of the lower skirt allow the crankcase bypass passages to open as the piston approaches bottom dead center (BDC), allowing an unobstructed flow of air/fuel mixture to the cylinder transfer ports; this also lightens the piston—always good for a high-speed engine. Piston-to-cylinder clearance at top dead center (TDC) is 0.003 inch (0.076mm). Its clearance at BDC is 0.004 inch (0.102mm). The piston's diameter is a uniform 1.415 inches. Weight with ring: 28.9 grams.

• **Wristpin.** The hardened and ground steel alloy pin has been blind-bored for lightness. It is held in the piston by two C-clips that snap into place in shallow grooves at the outer limits of each piston boss. The pin is slip-fit into the piston with a clearance of 0.0008 inch (0.02mm). The pin diameter is 0.3342 inch (8.49mm). This free-floating arrangement is intended to receive lubrication from the fuel and prevent the wristpin from seizing. Weight with clips: 8.4 grams.

• **Connecting rod.** Made of aluminum alloy with bronze bushings at both the crankpin and wristpin ends, the crankpin has a lubrication slot cut into its end; the wristpin end has a drilled oil hole. The center-to-center rod length is 2.346 inches (59.59mm). The connecting rod to wristpin clearance is 0.0008 inch (0.02mm). The connecting rod to crankpin clearance is 0.002 inch (0.05mm). Weight: 20.7 grams.

• **Cylinder head.** Made of bar-stock aluminum alloy, the head is attached to the crankcase by six (4x0.7x16mm) Allen-head machine screws. Fourteen deep cooling fins (0.060 inch thick [1.52mm] by 0.480 inch deep [12.19mm]) provide the surface area needed (approximately 25 square inches [161cm^2]) to cool the engine. The combustion-zone portion of the head consists of a hemispherical chamber with a highly angled squish band (see the "Head and Combustion Chamber Dimensions" illustration). A 0.021-inch-thick (0.53mm) head gasket is interposed between the head and cylinder flange. Weight with gasket: 103.7 grams.

• **Backplate.** The standard backplate is a cast-aluminum, machined, bead-blasted unit that is attached to the crankcase by four, 5x0.8x10mm Allen-head machine screws. No gasket or O-ring is used to seal the crankcase gases; as Jim Gerard of



Gerard Enterprises is fond of saying, "Precision machining eliminates the need for gaskets." Weight: 61 grams.

• **Radial mount/backplate.** This cast-aluminum-alloy, machined and bead-blasted replacement for the standard backplate also requires no sealing gasket. The unit is secured to the crankcase by four longer, 5x0.8x20mm Allen-head machine screws. The outside diameter of the mount portion of the unit is 4.535 inches (115.19mm). The diameter of the three bolt holes is 4.335 inches (110.11mm). Weight: 213.5 grams.

• **Carburetor.** The case of this fuel-mixture-control carburetor is constructed of cast-aluminum alloy; the throttle barrel is hardened and ground and has a choke bore with a 0.412-inch (10.5mm) diameter. The unit's action is similar to that of the first YS carburetor of 1972. Like the YS, a large mixture-adjustment wheel is on the left side. Internally, this adjustment component forms the familiar two-O-ring-sealed reservoir that communicates with and controls the fuel flow from the sweptback primary needle valve to the throttle barrel. When the throttle barrel is rotated, a mixture-control slit and a hole within the barrel index with a hole in the reservoir. By rotating the adjustment wheel counterclockwise (toward the "+" stamped on the wheel), the transition and idle mixture will be enriched. Moving the wheel clockwise (toward the "-" stamped on the wheel) will lean the transition and idle mixture. Besides the big mixture-adjustment wheel, another obvious feature is the simple, single plane of rotation throttle barrel. There's no three-dimensional side-to-side action combined with rotation as there is with twin-needle mixture-control carburetors. This allows a compact, bind-free throttle and linkage action.

One innovation attributed to Jim Gerard is the true venturi cross-section of the carburetor; in particular, the expanding area below the throttle barrel. In part, this unobtrusive modification is credited for Moki's outstanding throttle response. The carburetor is O-ring-sealed to the crankshaft housing and retained by a cinch-pin clamping mechanism. Weight: 91.7 grams.

• **Glow plug and machine screws.** Weight: 49.7 grams.

ENGINE BREAK-IN

As do all of its large engines, Moki's 2.10 has a chrome-plated steel cylinder and a cast-iron piston ring that require a break-in period on the test stand. I followed Gerard's suggestions: "... it is best to run your engine as rich as possible during the first phases of the break-in procedure ... a speed of approximately 6,000rpm with the recommended 20x8 Moki prop." I used an APC 20x8 with good results. He continues: "After the first 20 to 30 minutes, you can lean [the engine] out for short periods of time. When the engine will hold a peaked setting without slowing, it can be considered to be broken in. Never attempt to accumulate all of the break-in time in one run. It is always best to run the engine in short runs of 2 to 3 minutes and let it cool down before starting it again. Do not run at low throttle settings during break-in. Run the engine at full throttle and slow it down by richening the fuel mixture."

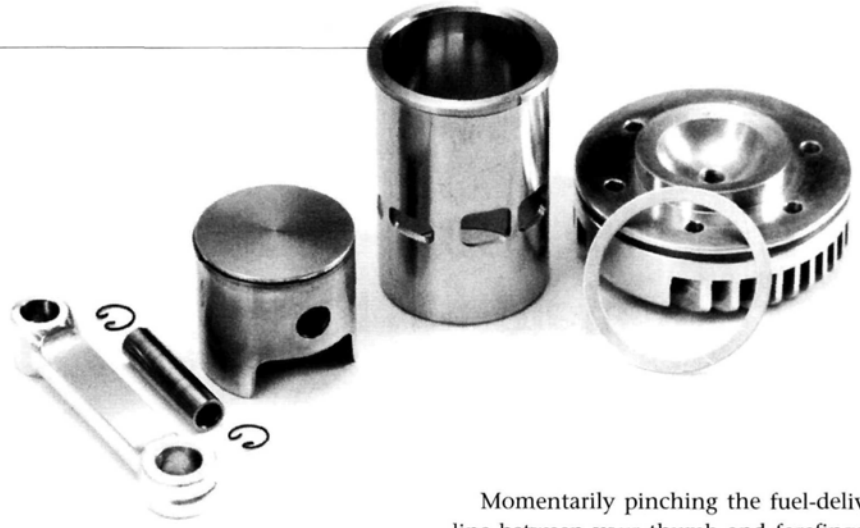
The Moki should be operated with muffler pressure during break-in. If you have a muffler of the Bisson Sport type, which was used for these tests, the task is simple: run a length of fuel line between the muffler's pressure fitting and the overflow vent on the fuel tank, and you're in business. If you aren't set up to run muffler pressure, the engine will perform nicely on suction feed, but be sure to mount the tank so its centerline is slightly (¼ inch) below the inlet nipple on the carburetor. Later, when you're preparing your model for flight, a pressure fuel-feed system will be mandatory.

I followed the starting procedure as recommended by Gerard: "... the needle-valve setting (for starting) is four to five turns from the fully closed position. It is always better to be on the rich side

The engine has a removable front crankshaft housing. The one-piece crankshaft is hardened and ground to perfection. A brass truncated split cone locks the drive washer to the crankshaft and inner race of the front bearing.

when starting a new engine. Before connecting the battery, open the throttle, and choke the engine by briskly flipping the prop three times while holding your finger over the carburetor intake. Before connecting the battery, flip the prop three more times without choking it. The Moki 2.10 likes to be started 'wet' ... close the throttle to about ¼ and connect the starting battery."

The engine started very easily using this technique, especially when using a clockwise starting flip. If you use a chicken stick, flip the engine clockwise with moderate force toward the compression point. Note: you may have to reposition (rotate) the propeller on the crankshaft to establish a comfortable clockwise flipping position relative to the compression point. Propeller bounce-back usually results in an ignition event—and a normal counterclockwise start. For me, one-flip starts were the rule rather than the exception. This technique is appealing because many find it difficult to muscle the propeller through TDC (compression) without experiencing a nasty kickback—especially with a wet cylinder.



Top right: the chromed steel cylinder is complemented by a high-silicon-content aluminum-alloy piston fitted with a single meehanite compression ring. The wristpin is retained within the piston by two C-clips. Notice the oiling slit on the crankpin end of the connecting rod. A narrow squish band surrounds the hemispherical combustion chamber in the aluminum alloy cylinder head. Below, left to right: Bisson Custom Sport-type muffler with two machine screws used to mount it to the adapter; muffler adapter plate with two machine screws used to attach the muffler to the engine's crankcase; fuel-mixture carburetor with sealing O-ring; cinch bar and nut (to attach the carburetor to the crankshaft housing). Below right: standard backplate and retaining machine screws (lower). Integral backplate and radial mount with retaining machine screws (upper).

The following data and comments are from my break-in log:

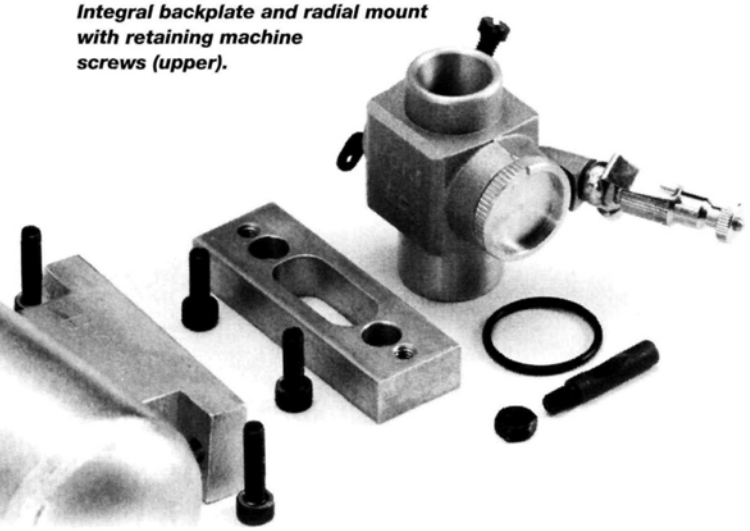
- 3 minutes @ 6,000rpm
  Won't run with battery disconnected.
- 4 minutes @ 6,000rpm
  Consumes 4 oz./min. at this setting!
- 4 minutes @ 6,500rpm
  Lean needle one turn to start.
- 4 minutes @ 6,500rpm
  Won't run with battery disconnected.
- 4 minutes @ 6,500rpm
- 4 minutes @ 6,500rpm
- 4 minutes @ 7,000rpm
  Runs without battery.
- 4:30 @ 6,500 to 7,000rpm Peaked briefly to 7,600rpm; smooth.
- 5 minutes @ 7,000rpm
  Peaked to 7,500rpm.
- 4:30 @ 7,000rpm
  Peaked to 7,900rpm; rich to lean, etc.
- 5:30 @ 7,900rpm
  Steady entire run. Slightly rich.
- 46:30 (sub-total)
  About 5 quarts of fuel were used to this point.

Momentarily pinching the fuel-delivery line between your thumb and forefinger is an excellent technique for quickly leaning the mixture; when used with an optical tachometer, it allows you to watch the rich/lean progression without wearing out the threads on the needle valve! For safety, remember to perform all operational procedures (after starting) from behind the engine.

I ran the engine in a similar manner for another hour before I was satisfied that break-in was sufficient for performance testing to proceed.

PERFORMANCE TESTING

I proceeded to mount and rpm-check 14 different flight propellers (see "Performance Data and Calculations"). I used the APC 20x12 composite propeller to determine the minimum reliable idle. Although I obtained a steady 1,400rpm with minimum adjustment, the big Moki didn't throttle up cleanly after 3 minutes. Gerard's standard is a crisp throttle-up after idling for 5 minutes (!) at 1,900rpm. Although most big engines tend to "load up" (collect liquid fuel in the crankcase) after a relatively short period of idling, the 2.10 didn't. There was also no sign of midrange richening as the throttle was rapidly opened to the wide-open position. The Moki system of fuel metering



(described earlier) and the unique cylinder transfer ports account for the outstanding throttle/carburetor performance.

Next, I rigged my test stand to check the static thrust with the suggested Moki Ultra 20x10 propeller. Moki USA states that it obtained 25 pounds of thrust with this combination. I obtained 26 pounds at 7,600rpm; maybe the atmospheric conditions were better during my test! This suggests that with a proper propeller (one that has been tailored for dynamic flight), unlimited vertical performance with a 20-pound airplane is probable.

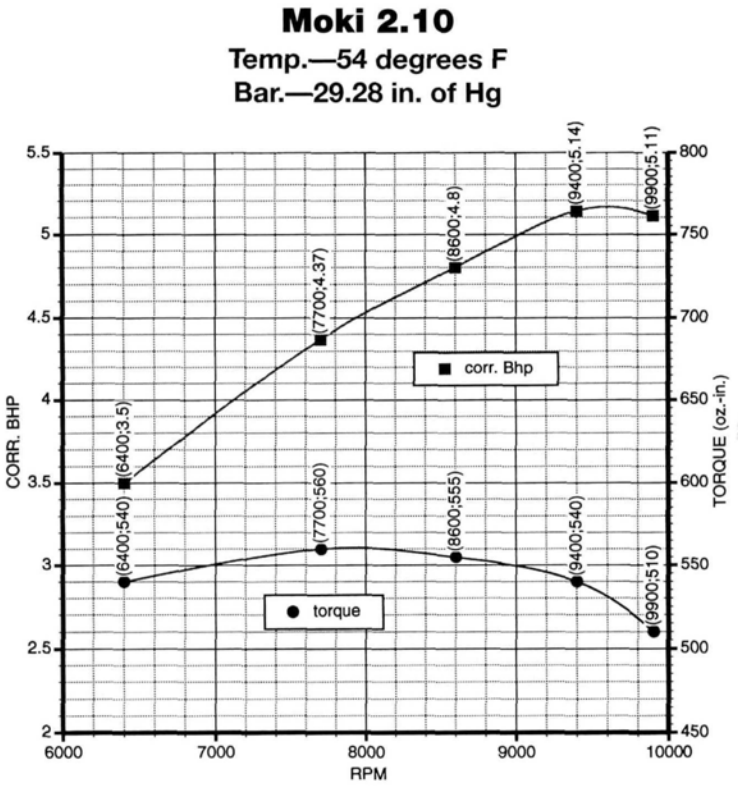
I checked the fuel consumption of the engine near its brake-horsepower (bhp) peak using an APC 18x6 composite propeller turning 9,400rpm with an optimized needle-valve setting. At this load, a flow rate of 2.5 ounces per minute translates to a specific fuel consumption (SFC) of 1.46 pounds per brake-horsepower hour (lb./bhp-hr.); this is better than average for this blend of methanol/nitromethane fuel. Specific fuel consumption is the standard engineering measurement of fuel economy; it's the mass (pounds) of fuel required to produce 1bhp for an operational period of 1 hour, regardless of the engine's displacement, number of cylinders, or other design considerations. Although I didn't check the consumption rate at other load points, the high-horsepower rpm usually represent the worst-case scenario, with improved (lower) SFC numbers occurring near the peak torque rpm with propellers such as the Moki Ultra 20x10 (7,600rpm) and the APC 20x8w (7,700rpm).

Dynamometer tests were accomplished using a newly constructed unit specifically designed for large engines such as the Moki 2.10. The measured torque and calculated horsepower (see "Performance Data and Calculations") for this engine represent the highest obtained from any model aircraft engine during my 30 years of testing.

In part, this outstanding performance is attributed to the Moki's large cylinder displacement, but this is only part of the story. At 2.44 bhp/cid, the 2.10 is one of the most powerful low-speed engines ever offered to the modeling fraternity, and all this occurs below 10,000rpm! Conversely, certain 2-stroke racing engines, e.g., those used in pylon racing, obtain very high horsepower per displacement ratios by applying a design philosophy that favors ultra-high rpm. Since horsepower (a calculated commodity) is the product of rpm and torque, useful propellers for these engines are limited to tiny, high-speed units. On the other hand, useful low-rpm torque is nonexistent to turn substantial propellers. In my opinion, comparing horsepower per cubic inch for engines designed to operate at opposite ends of the rpm spectrum is misleading, unrealistic and weighted to high-speed designs.

The Moki really shines by developing 266 oz.-in. of torque per cubic inch displacement on low nitromethane fuel and with a moderate effective compression ratio while maintaining a reliable idle and enviable throttle characteristics.

The third useful criteria for comparing the Moki 2.10 with other engines is torque per dollar invested. With a maximum torque of 560 oz.-in. and a street price of $339.95, the ratio calculates to 1.65 oz.-in. per dollar—a very favorable figure. In comparison, the winning engine from my ".40 Engine Shootout" article in the March 2001 issue of *Model Airplane News* produced 1.27 oz.-in. per dollar—27 percent less than the Moki 2.10!



ADDITIONAL INFORMATION

Every Moki engine that enters the U.S. is checked by Moki USA for cosmetic and mechanical defects, machine-screw tightness, carburetor metering and flow, plus various tolerances and clearances that Jim Gerard considers essential for outstanding performance and longevity. Last of all, the engine is placed in a plastic bag along with a set of well-written instructions before being shipped to distributors.

The Moki 2.10 is guaranteed to be free of defects in parts and workmanship for one year from the date of purchase. Crash damage or problems caused by neglect or abuse are not covered under the warranty.

Service and spare parts are available from both Gerard Enterprises and Horizon Hobby. The Moki propeller line is now distributed through Frank Tiano Enterprises (FTE). ✈

APC Props; *distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

Bisson Custom Mufflers, *RR 1 Taits Island, Box 32, Parry Sound, Ontario, Canada P2A 2W7; (705) 389-1156; (705) 389-1156.*

Frank Tiano Enterprises (FTE), *15300 Estancia Ln., W. Palm Beach, FL 33414; (561) 795-6600.*

Gerard Enterprises Inc., *13435 Rosewell Dr., Brookfield, WI 53005; (414) 784-4510; fax (414) 784-4520.*

Horizon Hobby Inc., *4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511; www.horizonhobby.com.*

K&B Model Products Inc., *P.O. Box 98, Sierra Madre, CA 91025; (626) 359-9527; fax (626) 301-0298; www.modelengine.com.*

Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742; (916) 631-8385; fax (916) 631-8386.*

Moki; *imported by Gerard Enterprises Inc. and distributed by Horizon Hobby Inc.*

Zinger; *distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710; (310) 539-2313.*

EUROCOPTER EC155B Dauphin N4

by Rick Bell

Len Mount of Gravesend, Kent, England, is a very well-known helicopter modeler. He has competed in many aerobatic contests, including the world championships. A few years ago, Len retired from competitive aerobatics and turned his talents toward scale modeling. He produces some of the biggest and best scale helicopter models around. His projects include a ⅙-scale Cobra AH-1S that is more than 7 feet long! Len's other models include a Westland Lynx, a Bell Jet Ranger and an Airwolf.

Most recently, Len built a Eurocopter EC155B Dauphin N4, the newest addition to the Dauphin family of utility helicopters. You might recognize earlier versions of the Dauphin as the search-and-rescue helis used by the U.S. Coast Guard. The Dauphin N4 features a 5-blade spheriflex main rotor head and an enclosed fenestron tail rotor. It's powered by two Turbomeca Arriel 2C1 engines and can cruise at over 140 knots. The Dauphin seats 12 passengers comfortably and has room for their baggage. It has a maximum weight of 10,582 pounds, a maximum useful load of 5,009 pounds and a sling-load capacity of 3,527 pounds with a takeoff power of 851 shaft horsepower and a maximum range of 449 nautical miles.

Len's stunning model is a faithful reproduction of the full-size helicopter. At 80 inches long, this ⅙-scale heli makes a very large model. The fuselage is constructed entirely of fiberglass and plywood; Len actually made the molds himself. Len designed the fuselage with a removable tail boom to make transporting easier, which means that the tail drive, navigation lights and tail servo wiring all have quick disconnects at the main joint.

The model features 26 doors, panels and hatches that open. All of the latches and hinges are handmade and functional or use magnets to secure them for flight. Of course, the model has retractable landing gear and detailed wheel wells.

The cockpit, too, is a work of art. It's handmade and crammed with all the details of the full-size heli, right down to the carpeting and upholstery on the seats! For his efforts, Len won the Best Cockpit award at this year's Top Gun competition, which included scale helicopters for the first time.

This 18½-pound model also features complete rivet detail, working navigation lights, all outer humps and bumps and a scale 5-blade main rotor head. The fenestron shroud tail rotor is also true to scale.

To finish the model properly, Len used paint direct from Eurocopter—no problems matching colors here! Though the model is handmade, Len, like so many of us, used a computer-graphics program to generate the markings on the heli. The images on the fuselage and vertical fin are particularly interesting—very precise, yet subtle.

Len also detailed the interiors of the various bays and compartments. The nose electronics were exceptionally well done, with various "black boxes," fittings and cables.

To get his helicopter airborne, Len uses an RC230 23cc Zenoah gasoline engine

with a Futaba 9Z radio for guidance. The most amazing thing about this helicopter is that Len only started building it in January of this year and had it ready in time for Top Gun—only 640 hours of building time; quite a remarkable effort! Of all the helis at Top Gun this year, the beautifully built and detailed Eurocopter EC155B was definitely my favorite.

SPECIFICATIONS

Designer: Len Mount

Length: 80 in. (202cm)

Width: 13¾ in. (35cm)

Height: 18 in. (46cm)

Weight: 18½ lb.

Engine: Zenoah RC230 23cc

Radio: Futaba 9Z with Futaba GV1 governor

Gyro: Futaba 301

Building time: 640 hours over 3 months

Comments: the model is a faithful reproduction of the full-size heli. It features retractable landing gear, a detailed cockpit, rivet detail, working navigation lights and fully detailed and functioning doors and compartments. The main and tail rotors are scale and functional. It's finished with factory paint for an exact match and completed with stunning graphics. Len placed second at the 2001 Top Gun scale heli competition and earned the Best Heli Cockpit award.

by Don Edberg

Setting up your radio for fun-fly models

You can greatly increase your fun-fly model's control responses if you use a computer radio. These models are very aerobatic, and when they fly, they can tie knots in the sky!

Usually, fun-fly models have at least five servos: two for ailerons and one each for elevator, rudder and throttle (Figure 1). The two huge ailerons are there to ensure good roll authority. With a computer radio, you can couple the two aileron surfaces to the elevator to make very tight loops and sharp corners. Also, you can make both ailerons go up at the same time for very steep but controlled landing approaches.

It's pretty easy to set up the model for all these functions. Most computer radios have built-in mixing functions for flaperons, airbrakes and elevator/flap coupling. Use these functions to get the best flying characteristics possible for these fun models. Of course, you may also want to use standard aerobatics functions, such as snap roll switches.

FLAPERONS

"Flaperons" is the name coined for the combined function of ailerons and flaps. The aileron surfaces move opposite each other for roll control (like normal ailerons), and they also move up and down in unison for flap action whenever the flap control (usually a knob) is moved (Figure 2).

Occasionally, a model's instructions will specify more up-aileron travel than down-aileron travel. This is called "differential." Some radios will not allow you to have both flaperon and differential functions operating at the same time. Though at first this might seem troublesome, it isn't a big deal. Within its menu, the flaperon function allows you to separately specify the up and down motions of each aileron, so you can create differential within the flaperon menu.

ELEVATOR-TO-FLAP MIXING

The use of mechanically coupled flaps and elevators began in the 1950s with control-line models such as the Nobler. Someone discovered that if you made the flaps drop with up-elevator, you would be able to do square loops much more effectively. These days, it works equally well when used with RC fun-fly models. Elevator-to-flap mixing applies channel mixing from elevator to flap, as shown in Figure 3. When you turn on this mix function, your aircraft will make very crisp corners in maneuvers, and loops will become very tight. The rate of mixing may usually be set differently for up- and down-elevator commands (outside and inside loops).

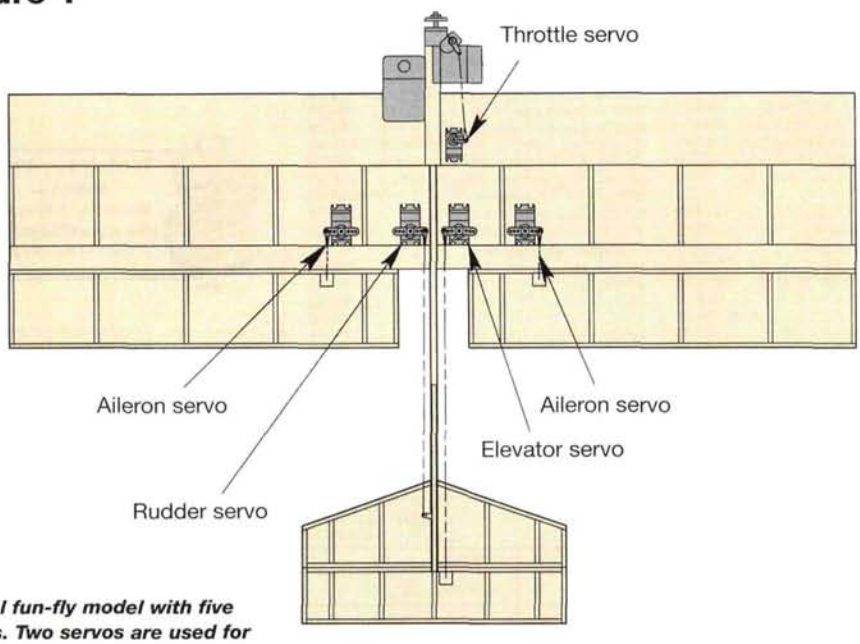
If flaperons and elevator-to-flap mixing are activated, both ailerons will droop when you pull up-elevator.

AIRBRAKES AND LANDING MODE

In some brands of radio, the airbrake mixing function is called "landing mode." This mixing function is useful for increasing the model's drag so you can increase the approach angle, making landings shorter, easier and more precise.

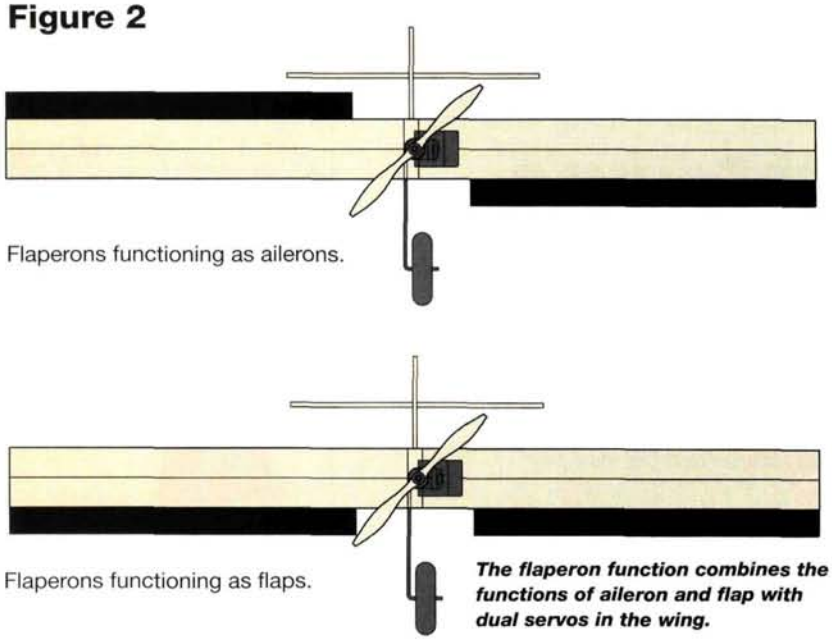
When activated, the airbrake function offsets the neutral positions of dual aileron servos and elevator to new posi-

Figure 1



Typical fun-fly model with five servos. Two servos are used for the ailerons.

Figure 2



The flaperon function combines the functions of aileron and flap with dual servos in the wing.

tions. The idea is to raise both ailerons simultaneously and trim the elevators to regain the lift lost by the up-aileron movement (Figure 4). This arrangement adds much drag to steepen the approach.

The airbrake function may be activated in several ways, depending on your make and model of radio. The first, and most commonly used, is in proportion to the throttle-stick position. If the airbrake function is turned on, once the throttle stick moves below a defined set point, the airbrake motion is controlled proportionally by the throttle stick, and maximum offsets occur at the low-throttle stick position. This is sometimes called the "linear" airbrake mode. Another way to set up the function is to set the airbrake function to deploy to its new position as soon as the throttle stick passes below the defined set point.

A third way you may choose to activate airbrakes is by flipping a switch. When you do this, it all happens at once: all the controls snap to their offset positions, regardless of the throttle-stick position. No matter which type of airbrake setup you use, the aileron and elevator controls allow you to make normal flying commands as your model descends steeply.

Some systems, such as Futaba's Super 8, provide a delayed-elevator-motion setting in the airbrake function. This delay slows the movement of the elevator servo so that it reaches its offset airbrake value at the same time as the aileron and flap servos do, even though they have to travel much farther than the elevator servo. This helps to prevent sudden trim changes when you activate the airbrake function. Note that the delayed-elevator function still allows the elevator to respond normally to the elevator stick as it slowly progresses to its offset position. Along with this feature, the Super 8 will emit a loud beep if it's powered up with its airbrake mixing switch turned on; this is to prevent you from taking off with the airbrake function turned on.

SETUP INSTRUCTIONS FOR A DUAL-AILERON-SERVO FUN-FLY MODEL

1. First, select your radio's aerobatic-model-type menus. These are often labeled "ACRO." This set of menus usually has the best functions preprogrammed for a fun-fly model. Select the desired model memory to work within, and if your system allows you to specify an alphabetic name, name the model now. Otherwise, make a note of the memory number so you won't forget which memory it's in.

2. Be sure that all of your servos are plugged into the proper receiver channels. Refer to your system's instruction manual for the proper channels, especially for the dual-aileron servos. For Futaba and Hitec systems, this is typically channel 1 for right aileron and channel 6 for left aileron. JR uses AILE and AUX2 channel outputs on the 8103. Airtronics may use channels 2 and 6. Please check your system's manual for the specifics.

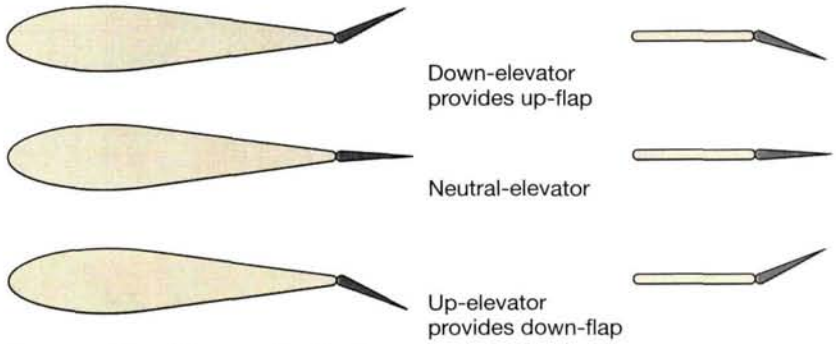
3. Turn on the transmitter and receiver, and do all the usual things such as setting travel directions, neutral positions and travel amounts. At this time, the second aileron servo will not respond to aileron-stick motion, and you won't be able to set it up, but all the other servos should work fine.

• Flaperons

4. Now activate your system's flaperon function. It may be abbreviated as FLPR, FLPN, FPN, or something else. This function, when turned on, will "slave" the second aileron channel to the aileron stick. With power on, verify that the second aileron moves in the opposite direction to the first aileron. If the second aileron servo doesn't move in the opposite direction, fix it in the next step.

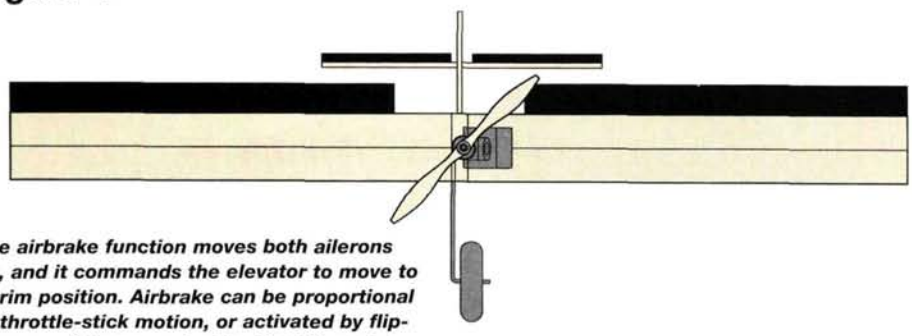
5. When the flaperon function is first activated, the joined up and down motions of the combined flaperons is usually controlled by a rotary knob on the transmitter. Most folks find this very inconvenient, as it's hard to center a knob without looking at it. Locate this knob and turn it until both ailerons are at neutral. If you

Figure 3



With elevator-to-flap mixing, moving the elevator automatically moves the flaps at the same time. With up-elevator and elevator-to-flap mixing turned on, both flaps droop.

Figure 4



The airbrake function moves both ailerons up, and it commands the elevator to move to a trim position. Airbrake can be proportional to throttle-stick motion, or activated by flipping a switch or moving the throttle past a fixed position.

want to, you can usually disable the flap knob by using a programmable mixer with both master and slave control set to FLAP and 100-percent mixing; or, just glue a piece of brass tube to the transmitter case to cover the knob so you can't turn it accidentally.

6. Verify that both ailerons as well as the elevator, rudder and throttle move in the proper directions with transmitter-stick movements. If the second aileron servo moves in the wrong direction, reverse it within the flaperon menu rather than in the servo-reversing menu. If you don't, the two ailerons may respond incorrectly to the special flap functions listed below.

• Airbrake function

7. If your system has an airbrake function, activate it by pressing the appropriate keys. Your display may indicate on or off—activated or inhibited; be sure your airbrake is activated, and remember which switch arms it.

8. Read your system manual and learn how to set up the airbrake system. You can usually turn the airbrake on with either a switch or by using a certain throttle position. If you choose throttle position, you will need to input the location on the stick travel where the function begins working. You won't be able to tell it's working by servo motion until you carry out the next step. You will, however, be able to see it turn on and off in the computer display as you move the throttle stick back and forth.

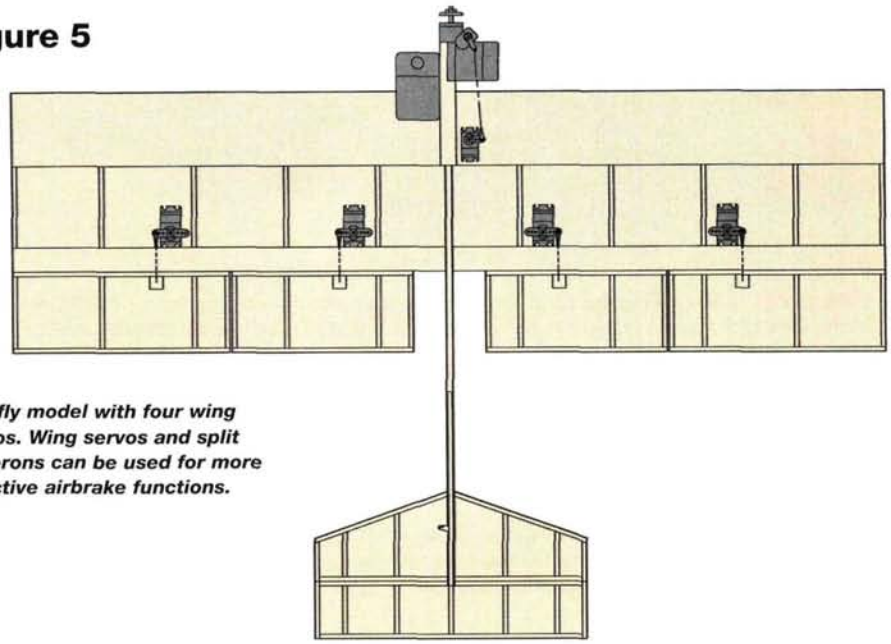
9. Now, go ahead and input the numbers (percentage of travel) for the recommended amount of aileron 1 and aileron 2 deflection. Take care that the motions of both ailerons match exactly, even if the setting numbers are different.

10. You can also specify the amount of elevator deflection desired. This adjustment is needed to prevent the model from ballooning when the airbrake function is activated, and it may be specified in the model's instructions. Usually, only 5- to 10-percent elevator motion is needed.

11. Be sure that you know how to deactivate the airbrake function, so it's on only when you want it to be. This is especially important when you first set up the elevator compensation. Do this while the model is high enough to ensure that you have time to recover if the amount or direction is incorrect.

12. You may wish to put the airbrake-on position at about ½ throttle. Later, you can move it up or down, depending on how fast the model descends during the approach. You can also change the amount of flap motion to adjust the steepness of the glide.

Figure 5



Fun-fly model with four wing servos. Wing servos and split flaperons can be used for more effective airbrake functions.

• Elevator-to-flap mixing

13. Open your radio's elevator-to-flap program menu, and activate the function. (It may be called E->F, E>F, or something else; check your manual.) You may need to input numbers to make servos move, as the default settings are usually zero.

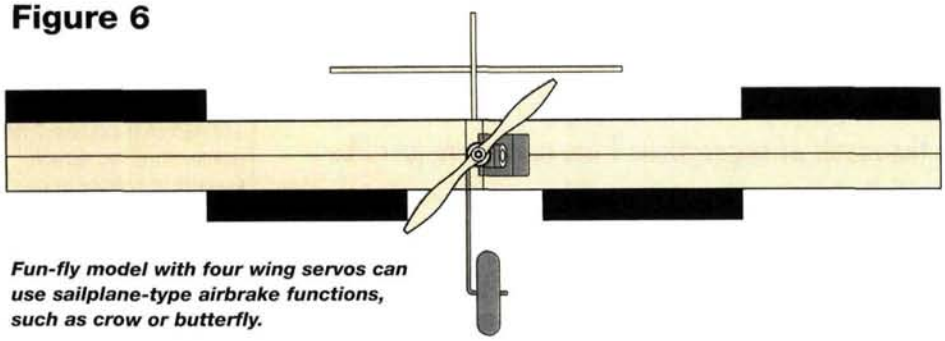
14. Input a number for the flap-mixing, and check the flaperon direction with the elevator stick; flaperons should move in an opposite direction to the elevator (Figure 3). If one flaperon moves in the wrong direction, reverse its motion in the flaperon menu (to make the flaps move together) and in the basic servo-reversing menu (to make the ailerons work together after the first adjustment).

15. Be sure to put in a number for the deflection for both elevator stick directions, as most systems have response settings for each elevator-stick motion direction.

TEST FLYING

Now you're ready to test-fly the model. Be sure you understand which switches activate the various functions and what should happen when each is activated. Make sure airbrakes are turned off for the first part of the flight. When you're ready and the model is several mistakes high, activate the airbrake function and determine how much elevator you need to trim the model and whether you want a shallower or steeper descent (decreased or increased flaperon droop). If the function

Figure 6



Fun-fly model with four wing servos can use sailplane-type airbrake functions, such as crow or butterfly.

is activated with throttle stick, you can also decide whether you want airbrakes to turn on earlier or later. Have a friend take some notes on what's needed, and adjust the model after you land. It may take several flights and adjustments to make the model fly just the way you want it to.

FOUR-WING-SERVO FUN-FLY MODELS

Some fun-fly models have provisions for four wing-control surfaces: one inboard control and one outboard control on each wing (Figure 5). Although this configuration is more difficult to set up, it offers increased airbrake-function performance. You can have more effective air braking by commanding the aileron controls to go up and the flap controls to go down at the same time and "fight" each other. This configuration produces lots of drag and allows the model to make very steep but controlled descents (Figure 6).

If you want this sort of programming, you basically have to do it yourself, unless your system has a glider mode designed to use four wing servos. These menus have a built-in "crow" (or "butterfly") function that will automatically do the four-wing-servo airbrake function for your fun-fly model and will replace the airbrake steps listed above.

Unfortunately, you will lose some aerobatic capabilities, such as snap rolls, if you go to the glider mode (you can, however, recover this with programmable mixers). You may also have to use a programmable mixer to get the throttle to work on the desired servo, since most gliders don't have throttles!

That's all there is to it! Remember, if you want to write to me, send email to man@airage.com, or write to "Effective Programming," c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. I get lots of mail, so please be patient!

IMAC Aerobatics

Straight and level flight

by Dan Wolanski

If you've read my series of flight-technique articles on how to perform individual International Miniature Aerobatic Club (IMAC) maneuvers, you will probably have noticed one factor that ties everything together: "straight and level flight." When flying an aerobatic sequence, you must start and finish each of your maneuvers in straight and level flight. Since straight and level flight signifies the end of one maneuver and the beginning of the next (see Figure 1), I thought it only fitting to dedicate an article to this portion of your sequence.

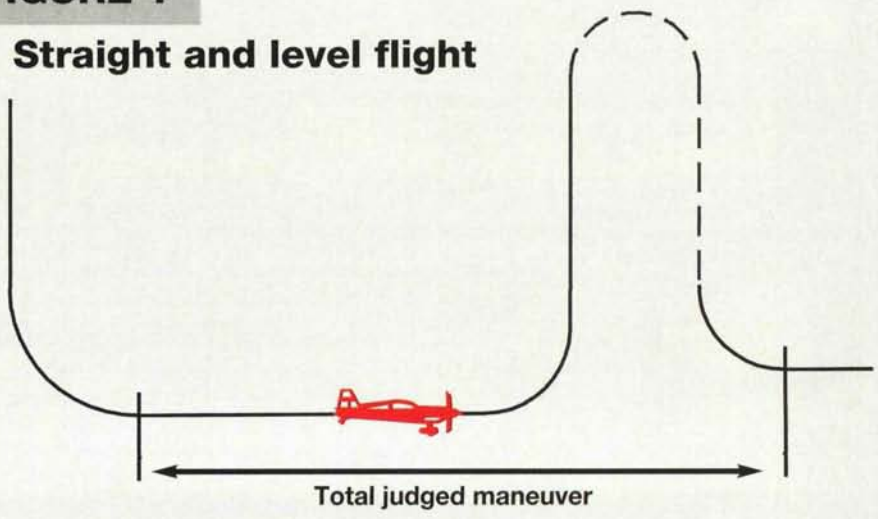
You should practice straight and level as much as you do any other maneuver. It is also where new precision-aerobatics pilots should begin. It may seem like the most boring thing to do, but in reality, straight and level flight is one of the most difficult maneuvers to master. Sure, rolling circles, tail slides and multiple snaps each have their own levels of difficulty, but think about what comes before and after each one of these: straight and level flight. One of the most difficult things to do after performing a rolling circle or a snap is to retain the same flight path. The judges look for your ability to regain control and execute the exit of the maneuver. To score well, you must learn what "wings level" looks like at various flight altitudes and box positions. And for this there is only one solution—practice.

Begin by flying your plane parallel to the runway about 100 yards away from yourself. When you reach the end of the aerobatic box (1,800 feet wide maximum), pull the plane vertical. If your plane does not head straight up, you didn't have your wings level (see Figure 2). Typically, most fliers hold their inboard wing too low during what looks to them like straight and level flight; when the plane is pulled into a vertical climb, it will start to come in toward the pilot.

Continue doing this at various altitudes until you can achieve a vertical pullout. As the plane continues upward, other forces such as prop torque will affect your plane, but you need only concentrate on the initial pull up for this exercise. If you find that you have to apply rudder immediately after you "pull" up-elevator, then you are not flying level. High-wing, mid-wing and low-wing planes will all look different in flight with respect to the ground. Your paint scheme can also "throw off" your perception of your plane's attitude. Learn what wings-level looks like by practicing it over and over.

Now let's take the wings-level exercise one step farther: inverted. Yep, throw out your previous sight picture and start again. In an aerobatic sequence, straight and level flight is not

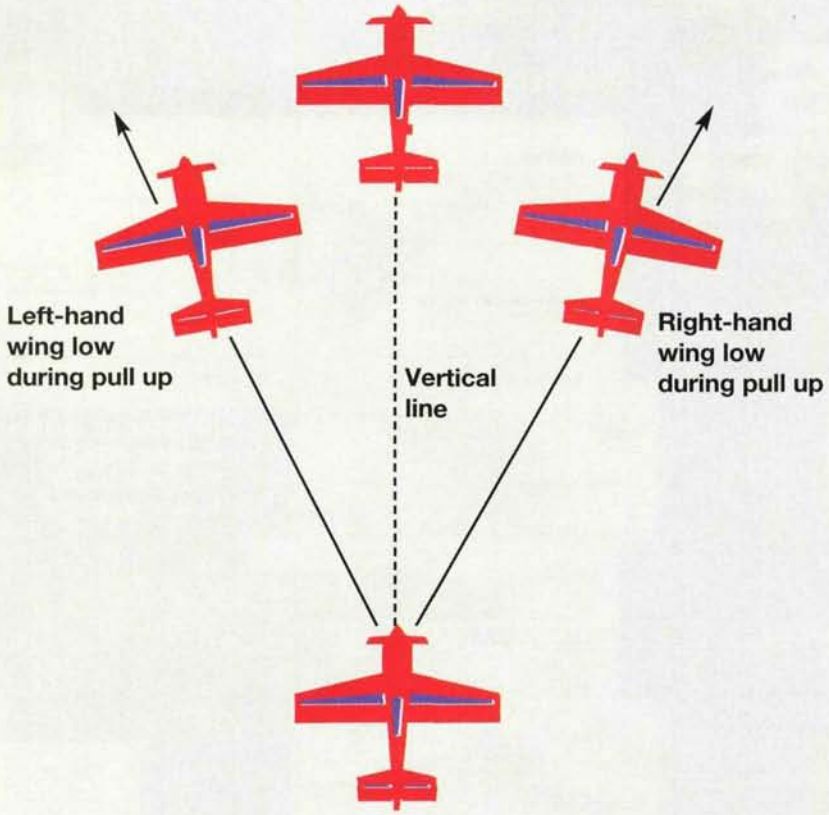
FIGURE 1



The horizontal line prior to the judged maneuver is also part of the maneuver and is subject to the same downgrades as any other part of the maneuver flown.

FIGURE 2

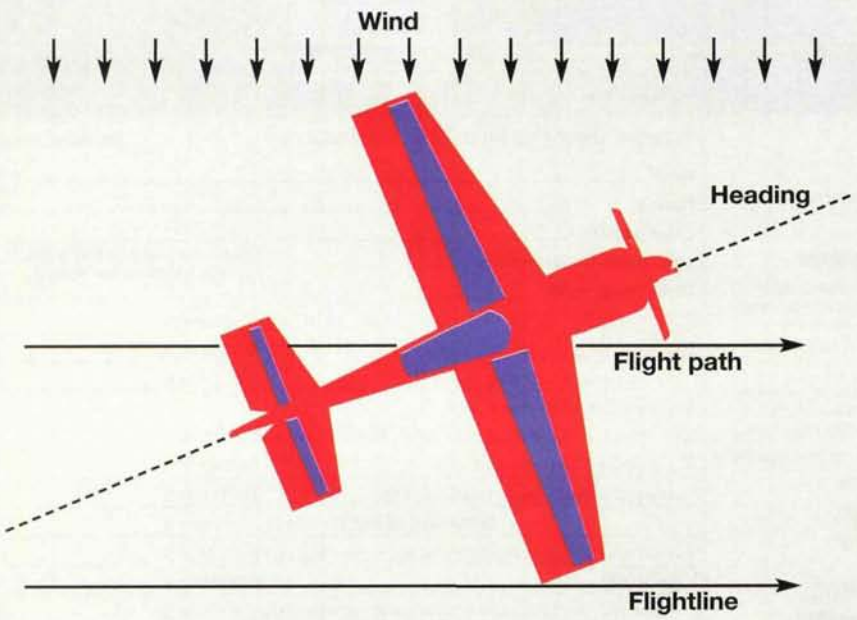
Wings level



Deviations in the vertical line shown are caused by entering the maneuver with the wings not level before the pull up. (No cross-wind assumed.)

FIGURE 3

Wind correction



Crosswinds will require the aircraft to be crabbed (i.e., its attitude changed) to maintain a flight path parallel to the flightline.

limited to upright flight only. In fact, you may spend as much as 30 percent of your flight time inverted while in between maneuvers. You also need to know what inverted wings-level flight looks like. Push down-elevator to enter into a hammerhead at each end of the box, and notice which way the plane immediately leans. Fix the lean angle on the next try with your ailerons immediately before adding the elevator push from straight and level flight. Once the push begins, only rudder should be used. The same thing goes for upright flight. Use the ailerons before the pull, and then use the rudder to correct during and after the pull into the vertical.

Wind correction is another factor that will influence straight and level flight and your vertical lines. (Note: "wind correction" means that you must lean the plane's heading slightly into the wind to keep the plane's flight path parallel to the runway and perpendicular to the ground during a vertical climb. See Figure 3.) If the plane is crabbed during a vertical entry, it will immediately lean toward the direction of crab. You may need to take *some* of the crab out of the plane with rudder immediately before the pull. (I emphasized the word "some" to signify that there is no hard-and-fast rule concerning how much to remove.) A certain amount of crab-angle wind correction should be maintained to keep it parallel to the runway. In IMAC competition, you may want to leave in some of this crab since all vertical maneuvers are affected by the wind direction. Each plane will act differently depending on its weight, the length of its tail moment and the amount of crosswind velocity. The only way to find how much crab angle you'll need to remove is by practicing.

It may seem simple, but I can't over-emphasize how important it is to master straight and level flight—for aspiring aerobatic pilots and seasoned veterans, as well. Think of it as the glue that holds your sequence of maneuvers together.

PRODUCT WATCH

Latest product releases

AT *MODEL AIRPLANE NEWS*, we not only tell you what's new, but we also try it out first so we can bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."

AIRWILD

Wild Gage

Three gauges in one

AirWild's Wild Gage is a digital, multi-function gauge that many modelers should find useful. It is a tachometer, a DC voltmeter and a continuity meter, all in one. The tachometer can measure the rpm of 2, 3, or 4-blade props, and the voltmeter can measure DC voltage up to 20 volts. The Wild Gage comes in a red plastic case that's 7¼x2¾x1 inches, has long test leads and is powered by a standard 9V alkaline battery. It has an LCD display with ½-inch numbers and two slide switches: one for on/off and blade selection and the other for function selection.

Operation of the Gage is straightforward and is adequately covered in the instruction sheet. As a tachometer, it can measure 2-blade propeller rpm from 100 to 60,000 and a 4-blade propeller up to 30,000rpm—much higher than the average modeler will ever require. The resolution is 100rpm, and the accuracy is +/- 1 percent. The Wild Gage is precalibrated at the factory for optimal tachometer operation. However, as a quick check of the validity of the tachometer reading, you can simply hold it up to a fluorescent light while it is in one of the blade-detection modes. The Gage should display "36" if it's in the 2-blade mode and "18" in the 4-blade mode.

As a voltmeter, it has two ranges: 2VDC and 20VDC, with resolutions of 0.001VDC and 0.01VDC, respectively. Both ranges have an accuracy of +/- 1 percent. The Gage is polarity protected, and the LCD screen will display a "-" symbol if polarity is reversed.

The continuity meter is, in fact, an ohmmeter, and it reads the resistance of a circuit in ohms. The objective of a continuity function is to detect whether there is an electrical connection between two points. A low resistance reading indicates a good, continuous connection, whereas a broken connection will show a very high resistance. Suggested applications include detecting an open or shorted glow-plug coil, an on/off switch failure, a break in a servo-extension wire and proper grounding of an electronic-ignition module for gas engines. I'm sure there are many, many others.

One feature I particularly like on the Wild Gage is that it uses a standard 9V battery rather than several expensive button cells. The Wild Gage sells for $45. —*Jim Onorato*

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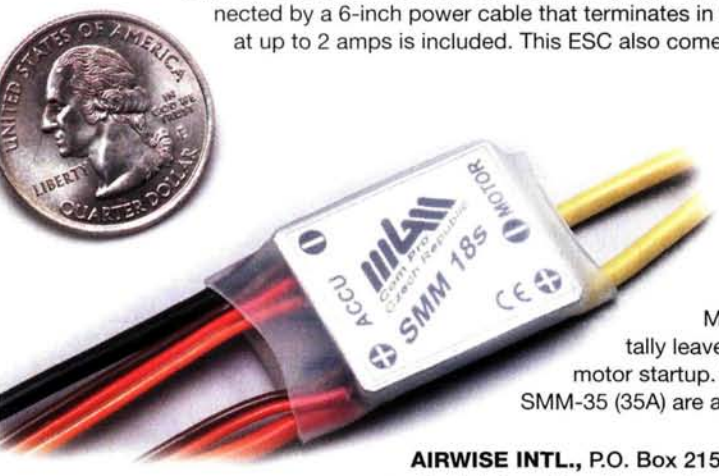
AIRWISE INTL.

SMM-18s

18A electronic speed control

The SMM-18s electronic speed control (ESC) is manufactured in the Czech Republic by MGM Compro and distributed in the U.S. by Airwise Intl. It is capable of handling up to 18 amps of current using 6- to 12-cell battery packs, so it's suitable for Speed 400 or Speed 500 motors (the 18A current limitation cannot be exceeded).

The SMM-18s is 1¼x⅞ inches, 5/16 inch thick and weighs 0.5 ounce (15 grams) including the cables and one servo/lead connector. The cables to the motor and battery are no. 16 gauge wire, and each cable pair is approximately 3 inches long. The RC receiver is connected by a 6-inch power cable that terminates in a JR-type connector. A battery eliminator circuit (BEC) that can handle 5 volts at up to 2 amps is included. This ESC also comes with an on/off switch at the end of a 4-inch cable.



In tests, the SMM-18s operated at full throttle with essentially no losses. I verified this by running the motor and measuring the current and prop—first with the battery connected directly, then with the ESC inserted in the circuit. The result was the same both times. The operating frequency of this ESC is only 1000Hz, which is slightly low. Even though a BEC is provided, there is no motor-cutoff control. The BEC will continue sending 5 volts to the receiver and servos, but the motor will not stop running. When the motor can no longer sustain the flight of the model, the radio will still be operating, so I don't see any potential problems.

Motor control was quite linear from startup to high speed. Also, if you accidentally leave the throttle in the high position, the microprocessor circuitry will prevent motor startup. The street price for this controller is $55.95. Models SMM-25 (25A rating) and SMM-35 (35A) are also available. —*Bob Aberle*

AIRWISE INTL., P.O. Box 215, Prattsville, NY 12468; (518) 229-3648; fax (518) 229-3389; www.airwiseinternational.com. ✚

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Congratulations to Peter Brown of Fountain Hills, AZ, for correctly identifying the August 2001 mystery plane as the Curtiss F6C-1 Hawk. In early 1925, the U.S. Army Air Corps (USAAC) commissioned the Curtiss Hawk fighter under the "P-1" designation. Later that year, seven Hawks entered service in the U.S. Navy as F6C-1s. They were nearly identical to the USAAC's P-1, and that stumped a number of readers. Many of you, however, successfully identified the call numbers and tail colors as Navy designations. The Curtiss Hawk biplanes were important to the U.S. military during the interwar years. Like their USAAC counterparts, the initial F6Cs were powered by Curtiss V-1150-1 (D-12) engines.

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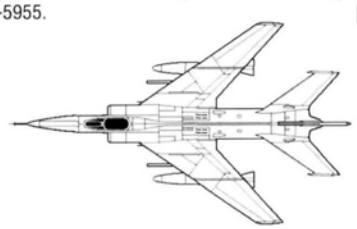
EVENTS

WEST ALABAMA AERO MODELERS annual Fun Fly In, Oct. 6 and 7, located in Tuscaloosa, Alabama. For more info, contact Eddie Fulmer, efulmer@aol.com, or (205) 339-5955. [10/01]



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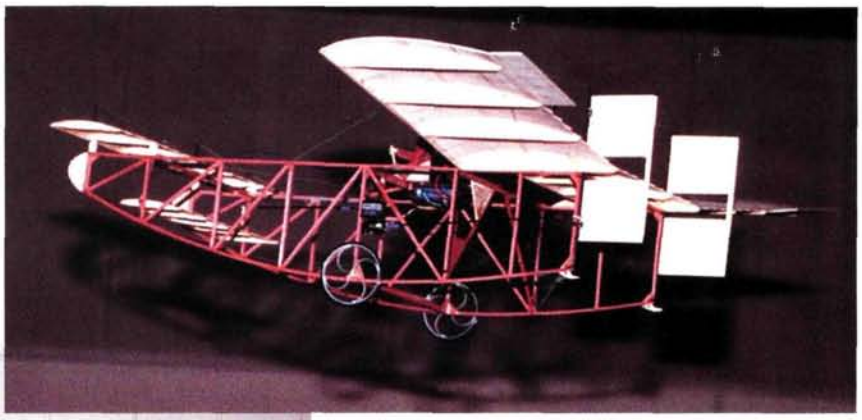
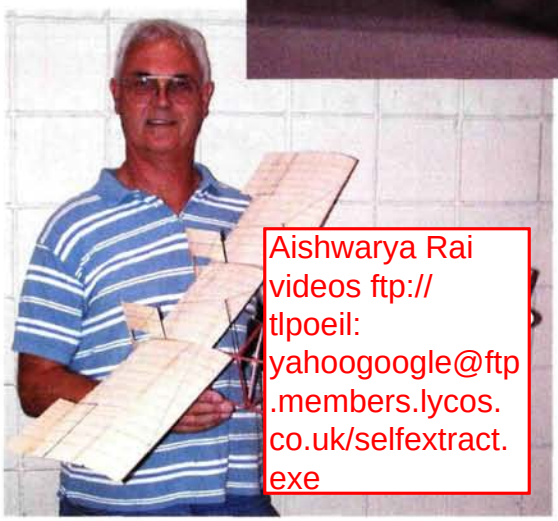
Micro-electric scale Masterpiece

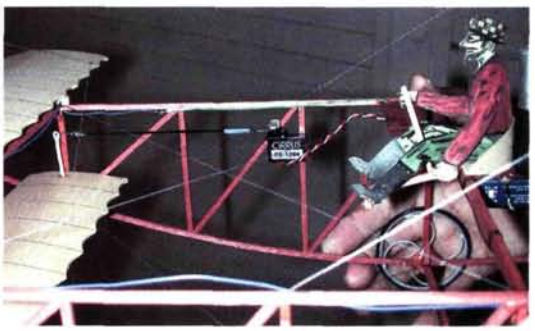
Steve Davis's impressive 1910 British Valkyrie shows the exciting potential of micro-electric scale modeling. This beautiful ship won second place at the indoor fun fly and competition held on May 18 and 19 at the Southwestern Aeromodeling Conference (Arlington Convention Center, Arlington, TX).



Charmed by the look of an old 3-view of the canard design, Steve scratch-built a hand-toss glider version to do some experimentation on proper CG placement. The prototype was soon gliding well, so he drew up some plans for this electric scale miniature.



Steve Davis, who hails from Arlington, TX, holds his scratch-built 1910 Valkyrie micro electric.

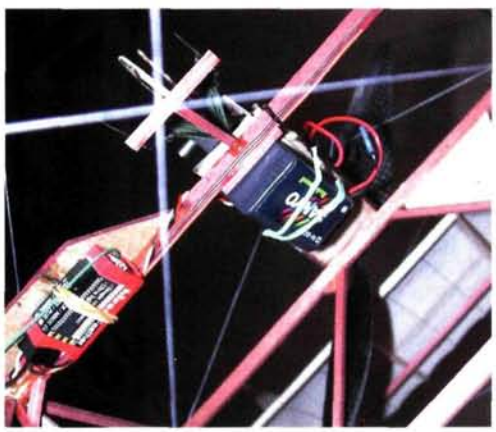


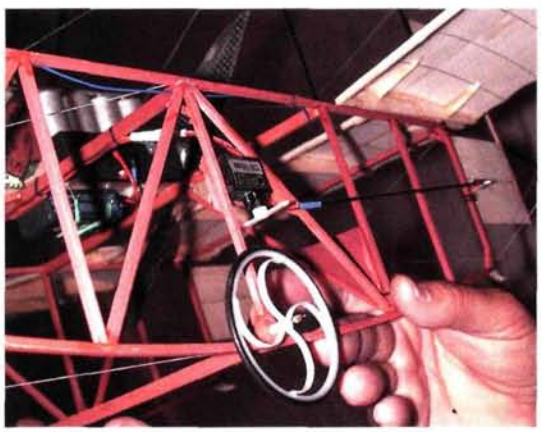
A Cirrus CS-10 microservo controls the full-flying canard elevator.

All-up weight of the 36-inch-span Valkyrie is only 6.5 ounces! It is built of single-sheet, 1/16-inch sheet balsa (the wings have underside ribs) and is strung with gray, carpet-thread rigging. The control rods are made of 0.050-inch-diameter carbon fiber. A WES-Technik 1524 motor turns a WES-Technik 9x5 carbon-fiber prop via a handmade 4.5:1 gearbox (this setup pulls about 1.15 amps at 7 volts). Electronics include a Hitec Feather receiver, an FMA 5 ESC and Cirrus CS-10 servos.

The model carries a 7.2V 110mAh Sanyo Ni-Cd pack (TA120) that resembles a traditional 9V transistor radio battery. This provides ample power for 4-minute flights (use of a lithium pack would raise flight times to the better part of an hour or more). The Valkyrie flies in a solid, stately manner with its full-flying, fully functional lower canard elevator—a real pleasure to behold. And it is only one of several scale micro electrics Steve has designed and flown.

For more examples of miniature scale electrics, see coverage of the Texas indoor fun fly and competition at www.rcmicroflight.com. Looking for like-minded modelers? Consider joining the National Indoor Remote-Controlled Aircraft Council (NIRAC); see http://www.nirac.org/home.htm, or the free, *Model Airplane News*-sponsored slow-flight list serve: http://www.rcmicroflight.com/lists/.





Left: a tiny, 7.2V, Ni-Cd battery powers the Valkyrie. Right: a second CS-10 servo operates the single left rudder.